

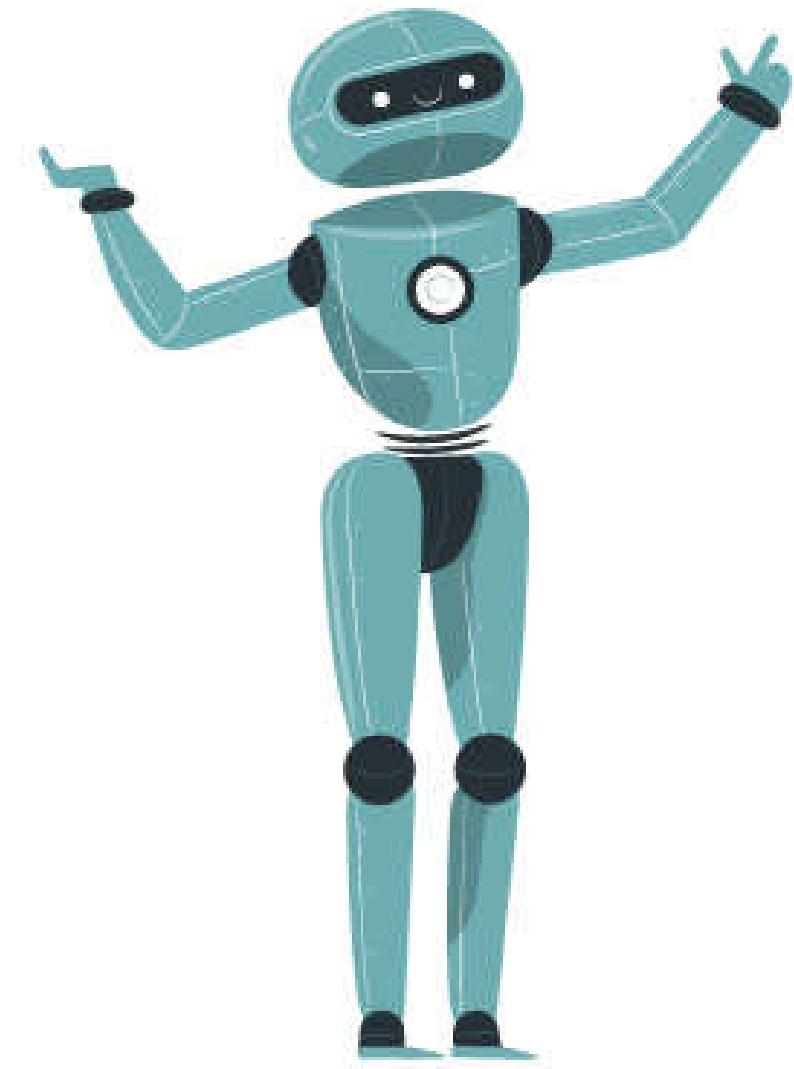


# E-LAB

Medical Diagnoses Using AI



# In this Presentation



- 01** Introduction
- 02** System Analysis
- 03** Machine Learning
- 04** Backend
- 05** UI/UX
- 06** Front-End
- 07** Mobile Application



# Introduction

# Early Diagnosis



**Improved Survival Rates**

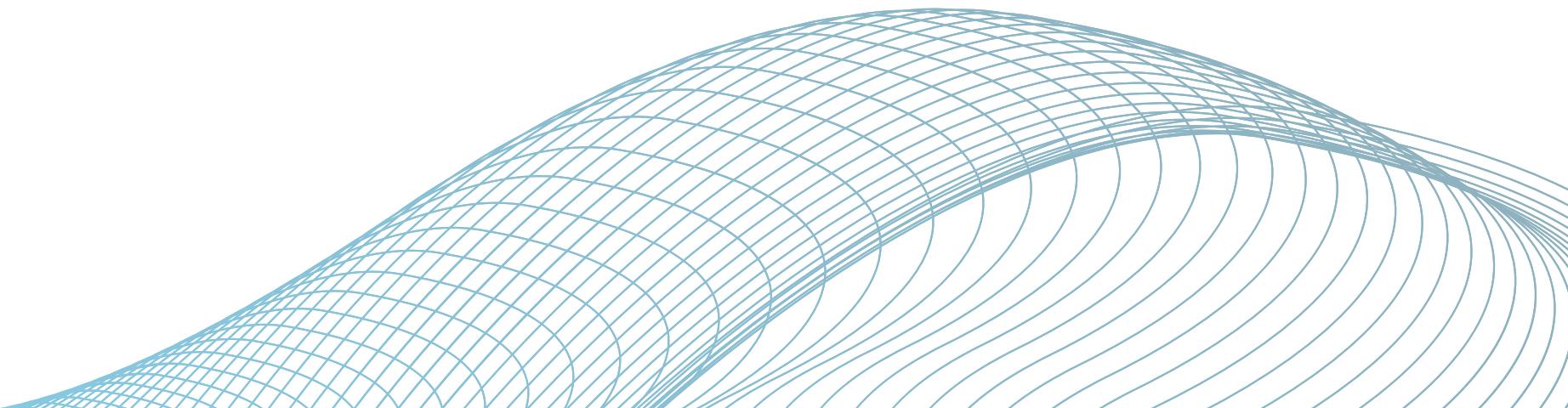
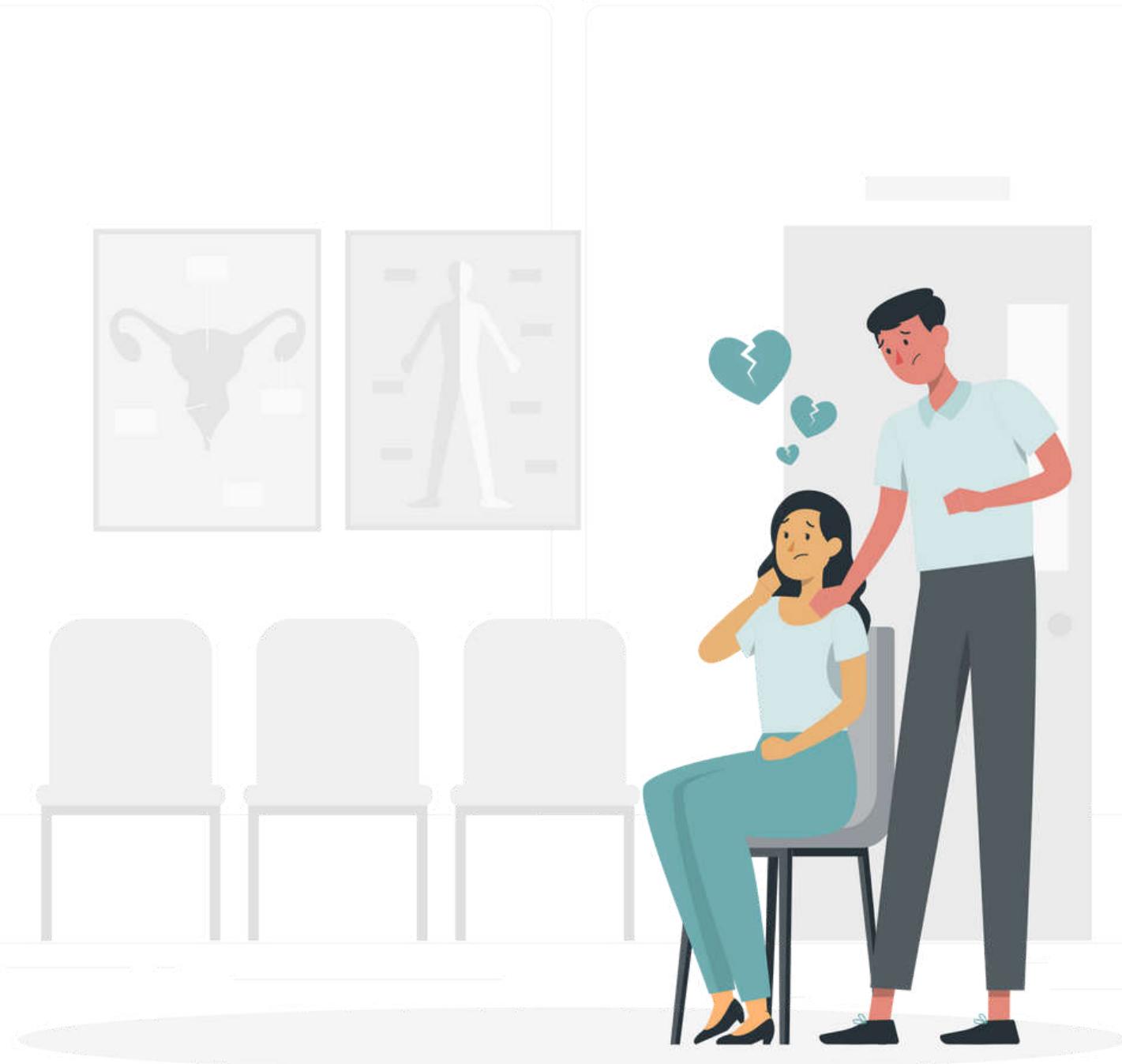
- 99%



**Reduced Healthcare Costs**



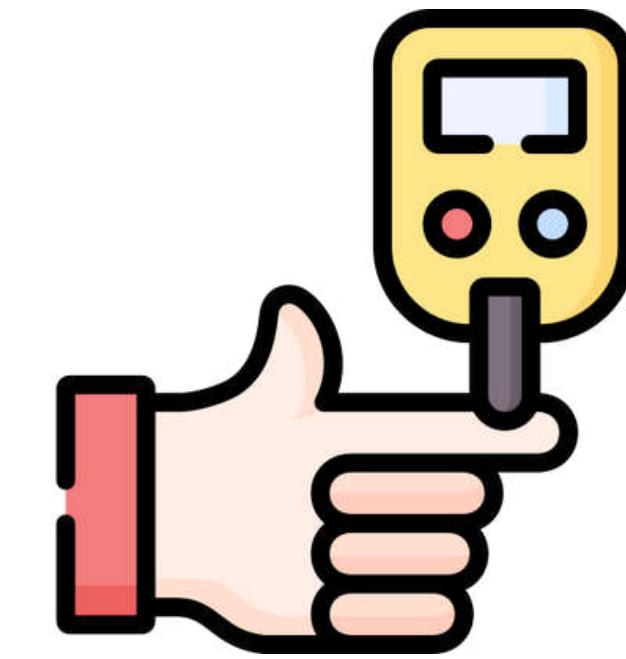
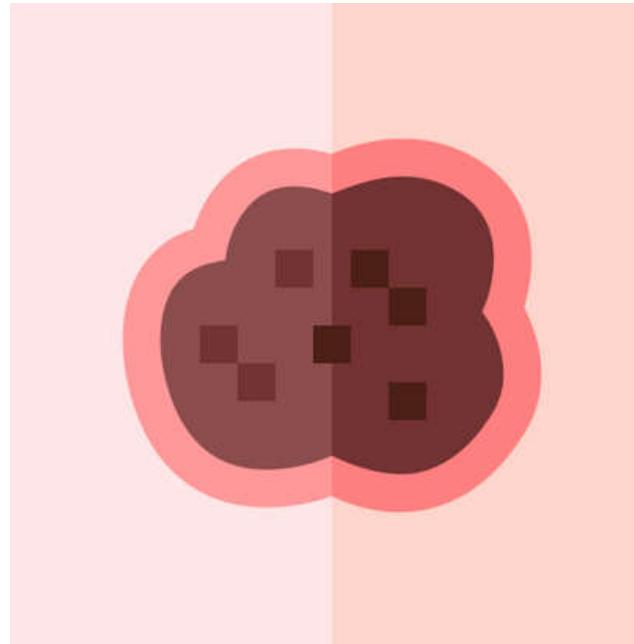
**More Effective Treatment**



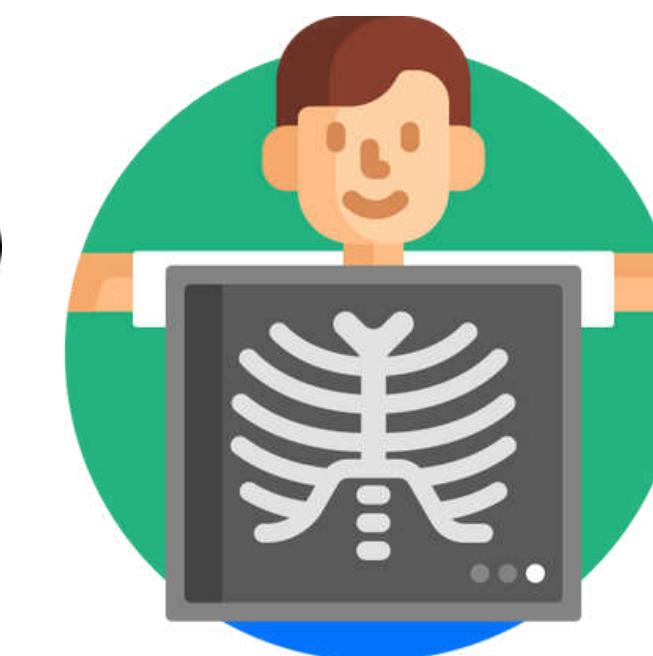
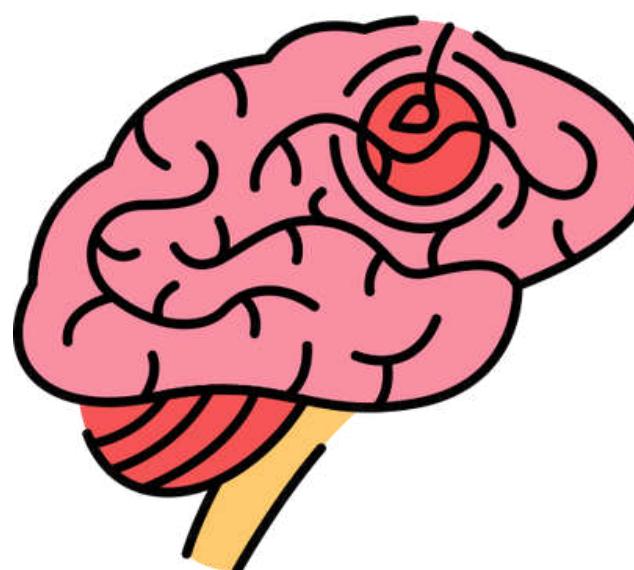
# Diseases



**Diabetes**



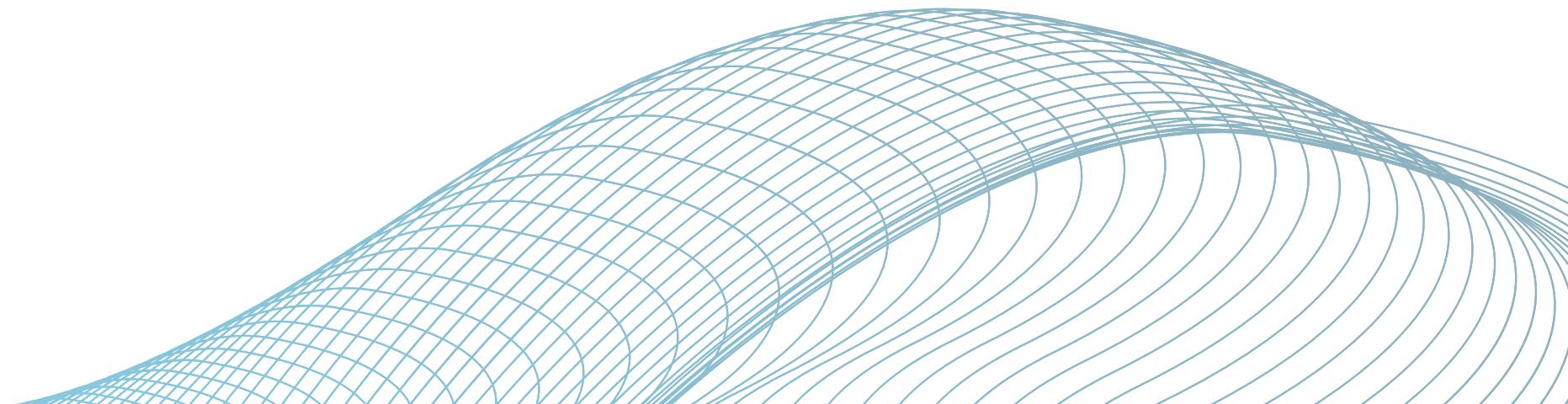
**Pneumonia(Chest X-ray)**



**Brain Tumor**



**Skin Cancer**



# System Analysis



# Functional & Non-Functional



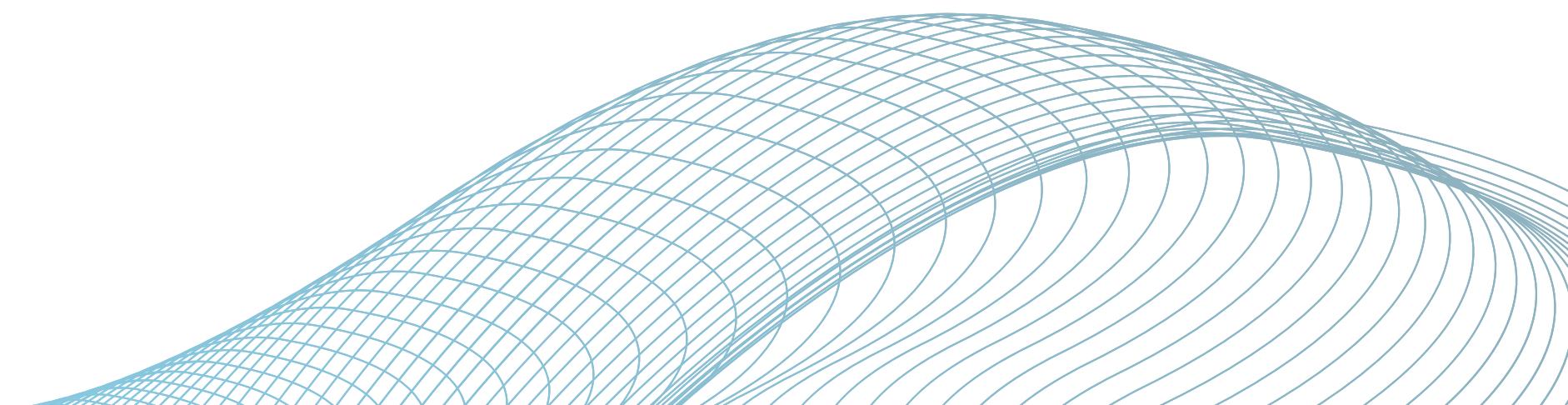
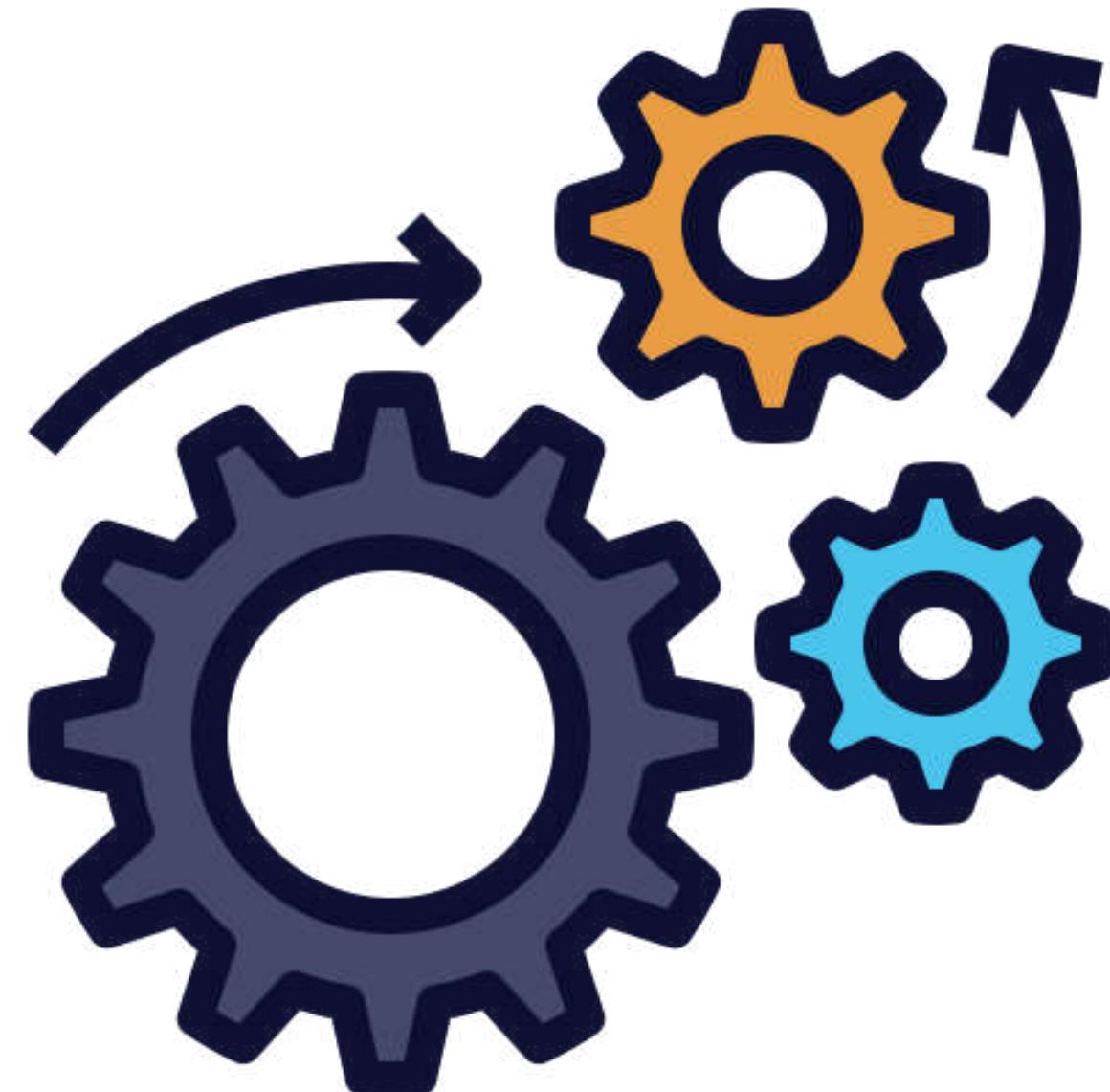
# Functional Requirement

Patient Medical History

Image Classification

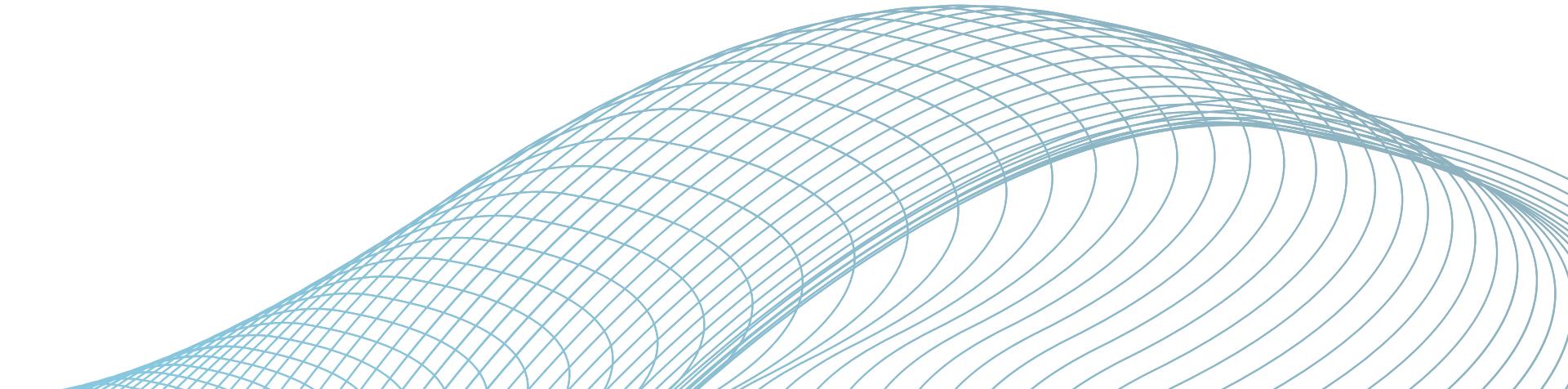
Numeric Classification

Result Display



# Non-Functional Requirement

- Login**
- Sign up**
- Security**
- Scalability**
- Availability**
- Performance**





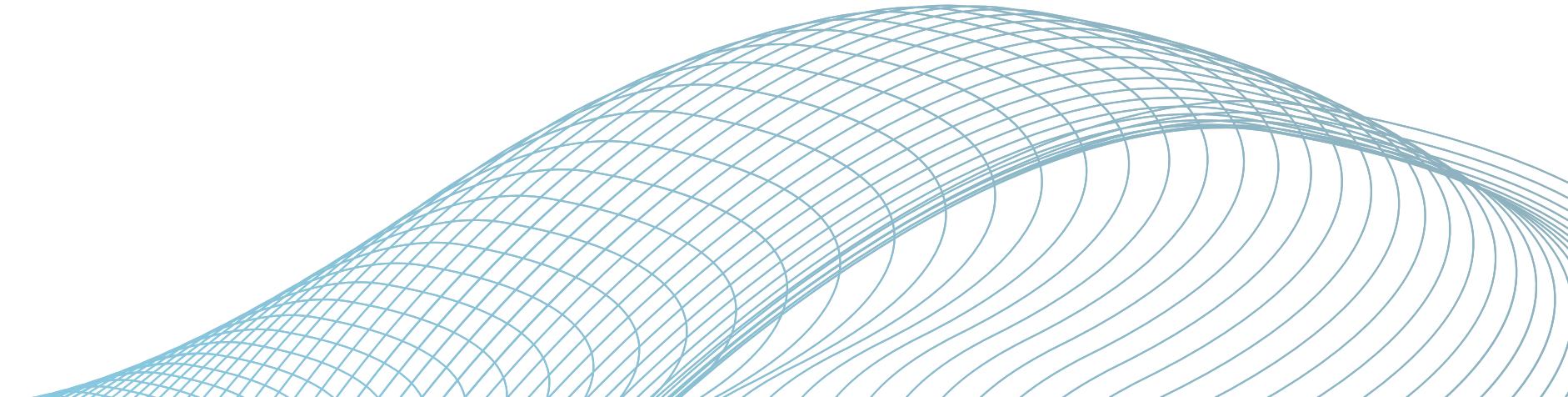
# Objectives

# Objectives

**Providing a User-Friendly UI**

**Providing a 24/7 Available Application**

**Quicken the Process of diagnosis**

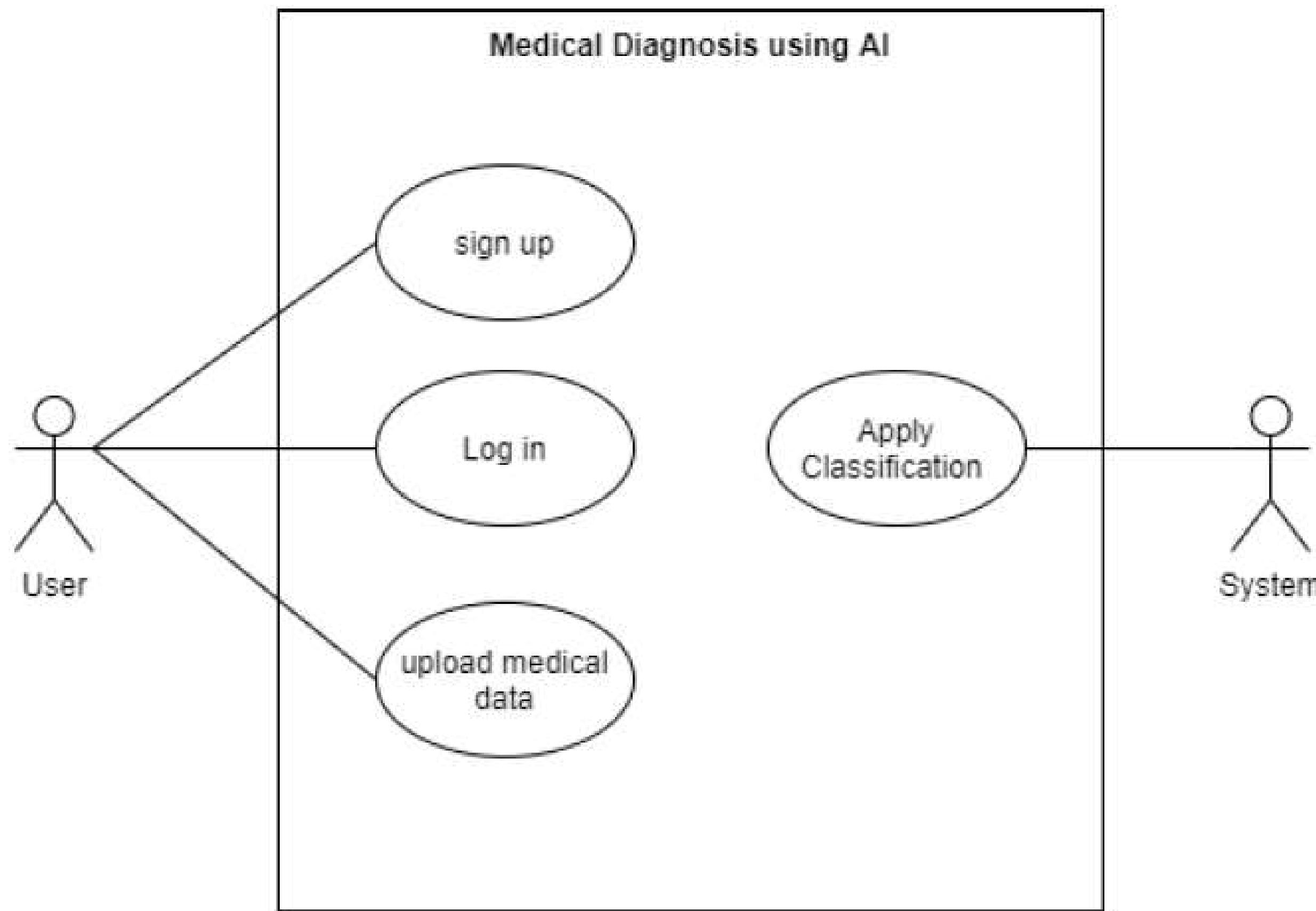




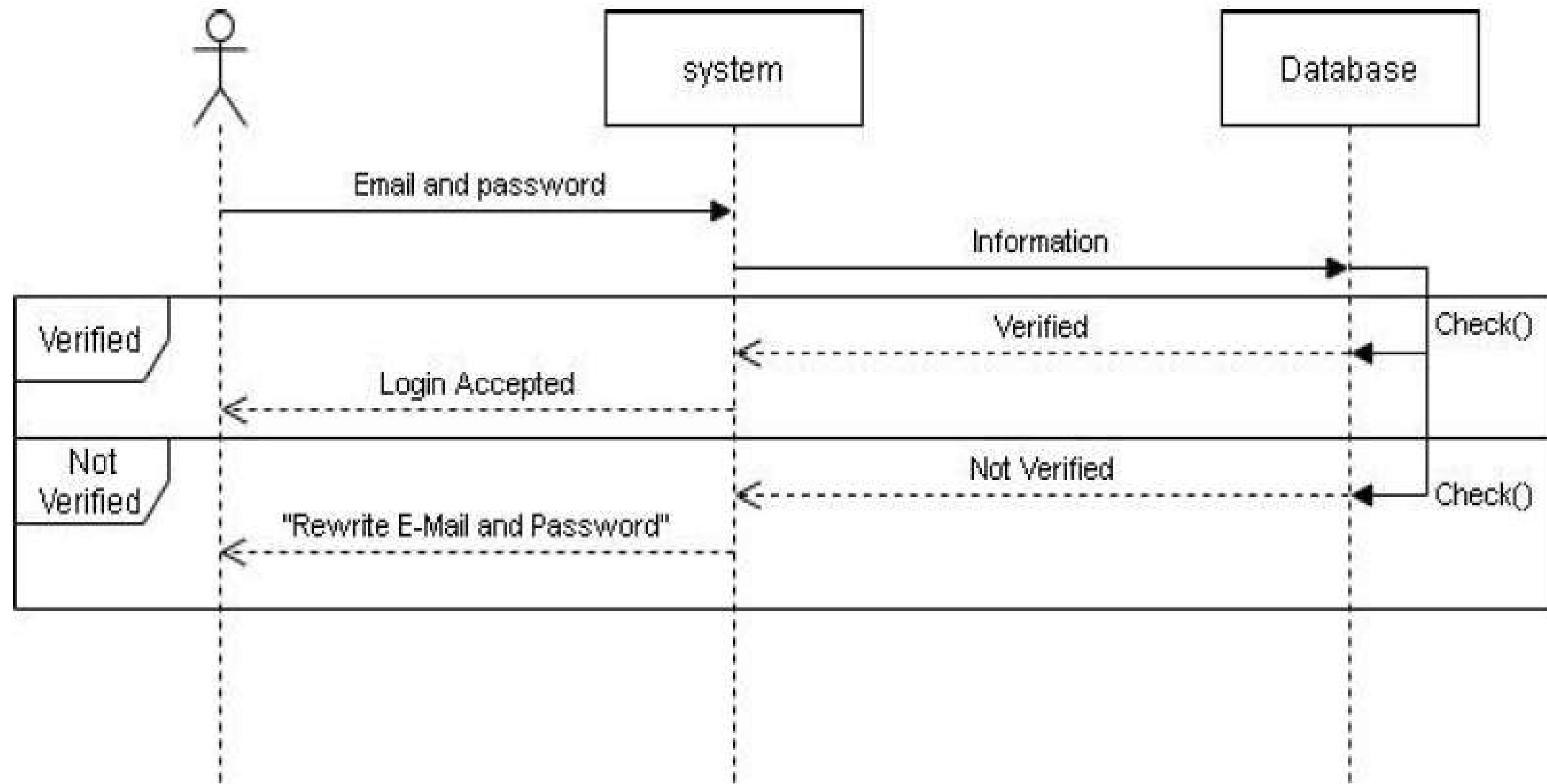
UML

Diagrams

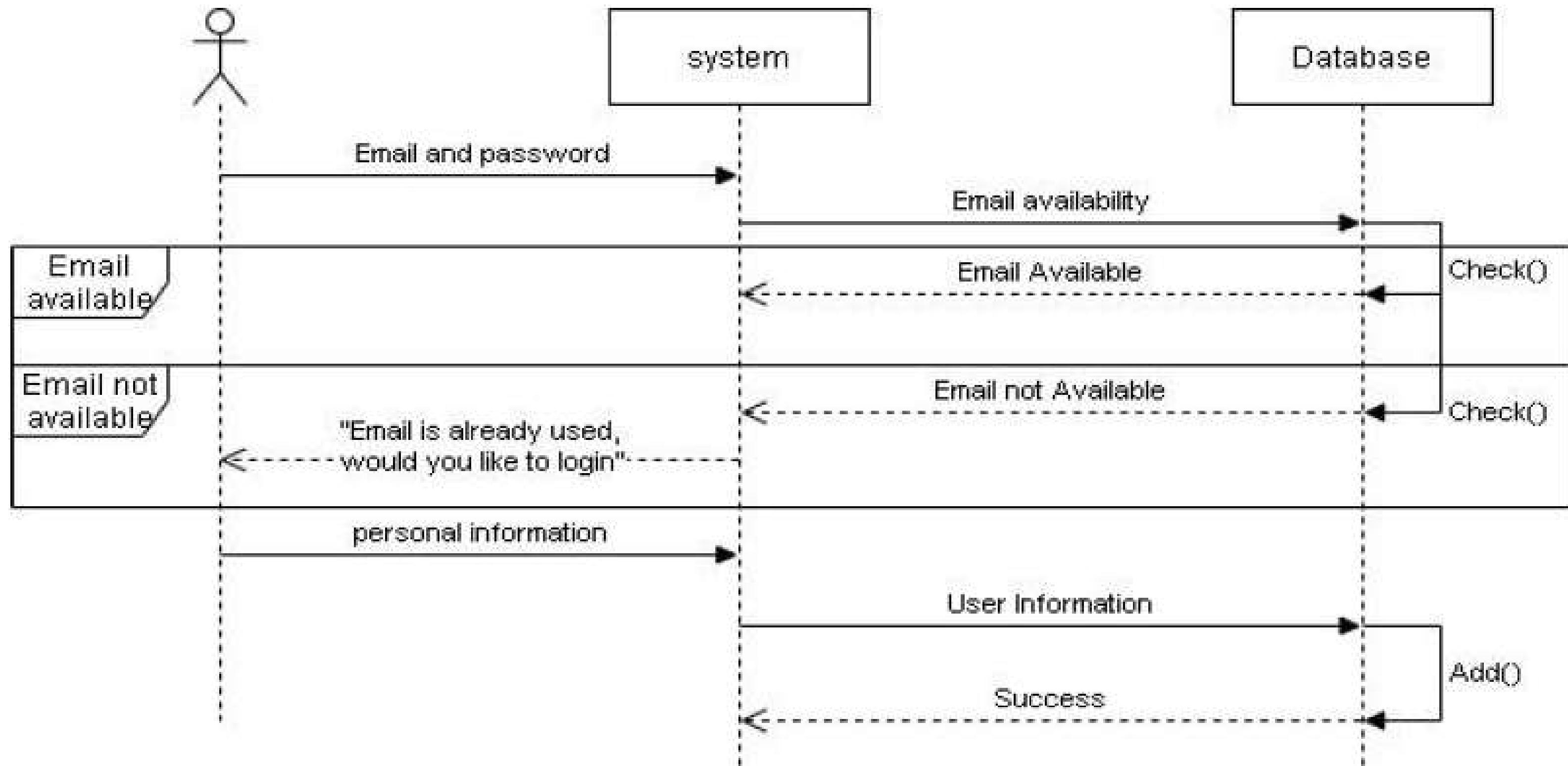
# Use-Case



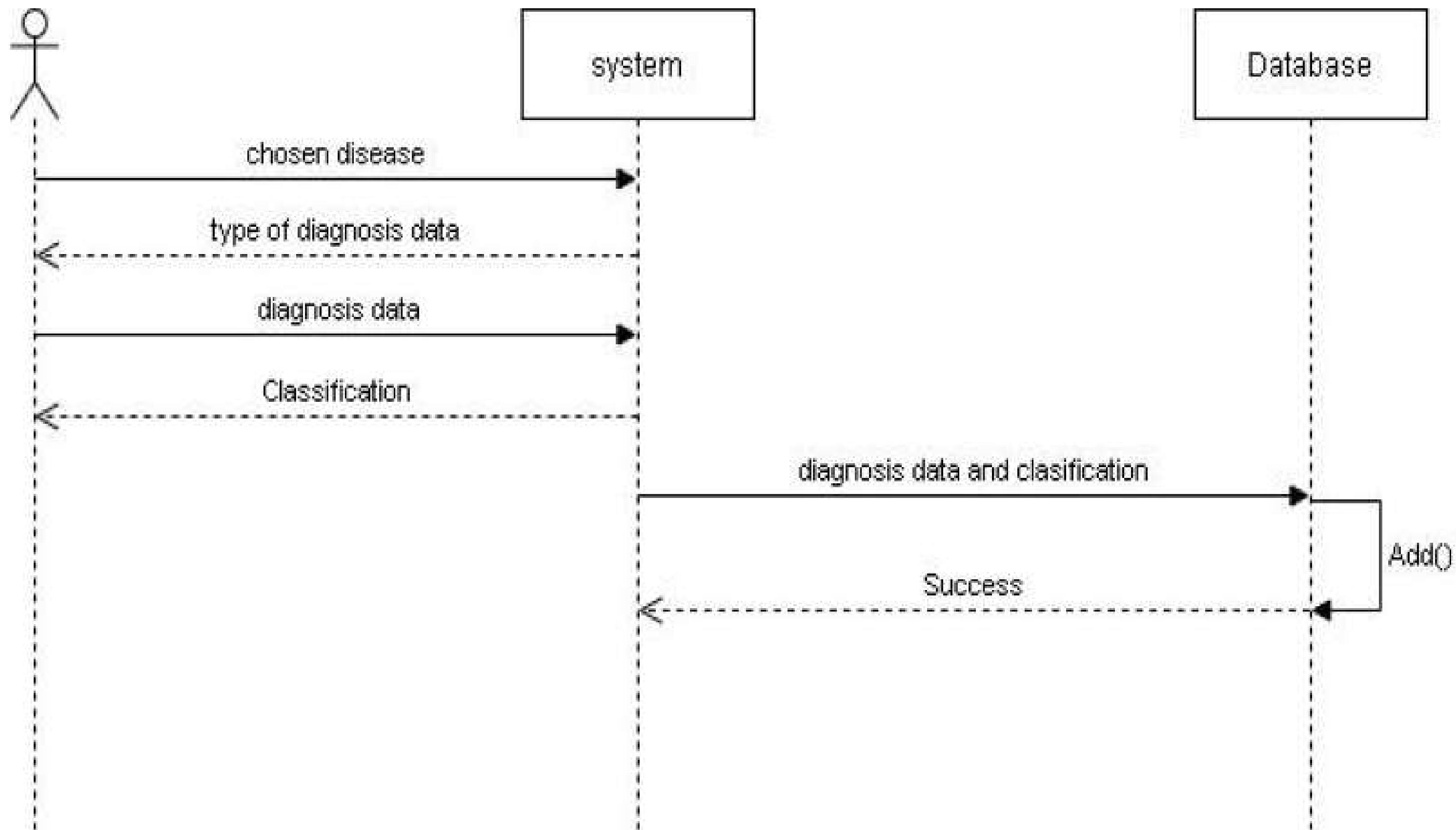
# Login



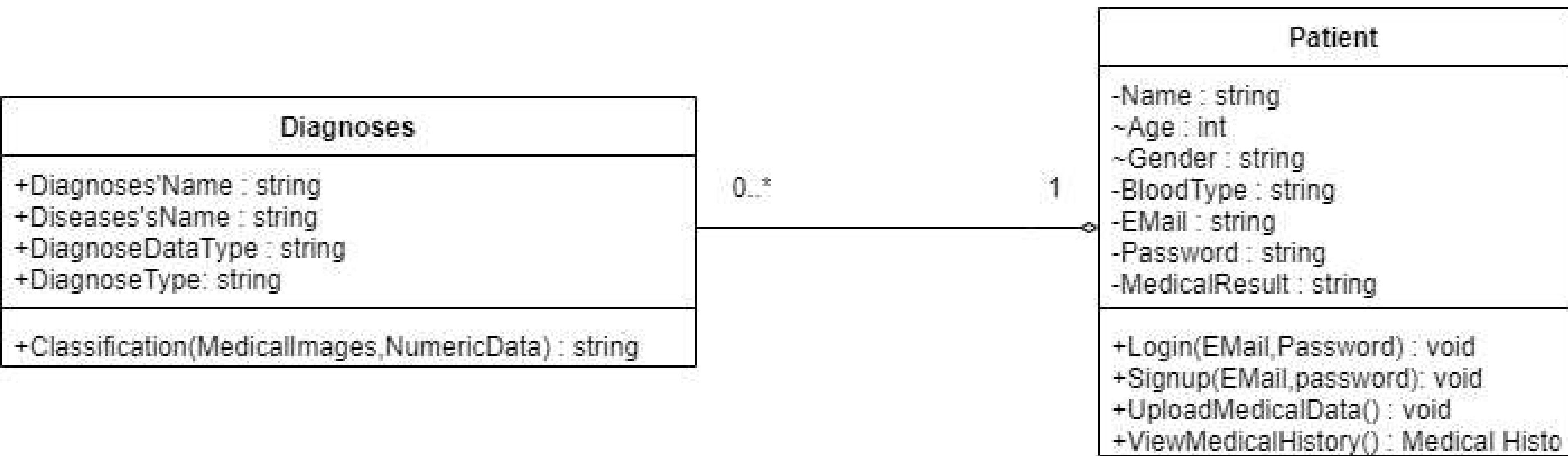
# Sign-Up



# Upload Medical Data



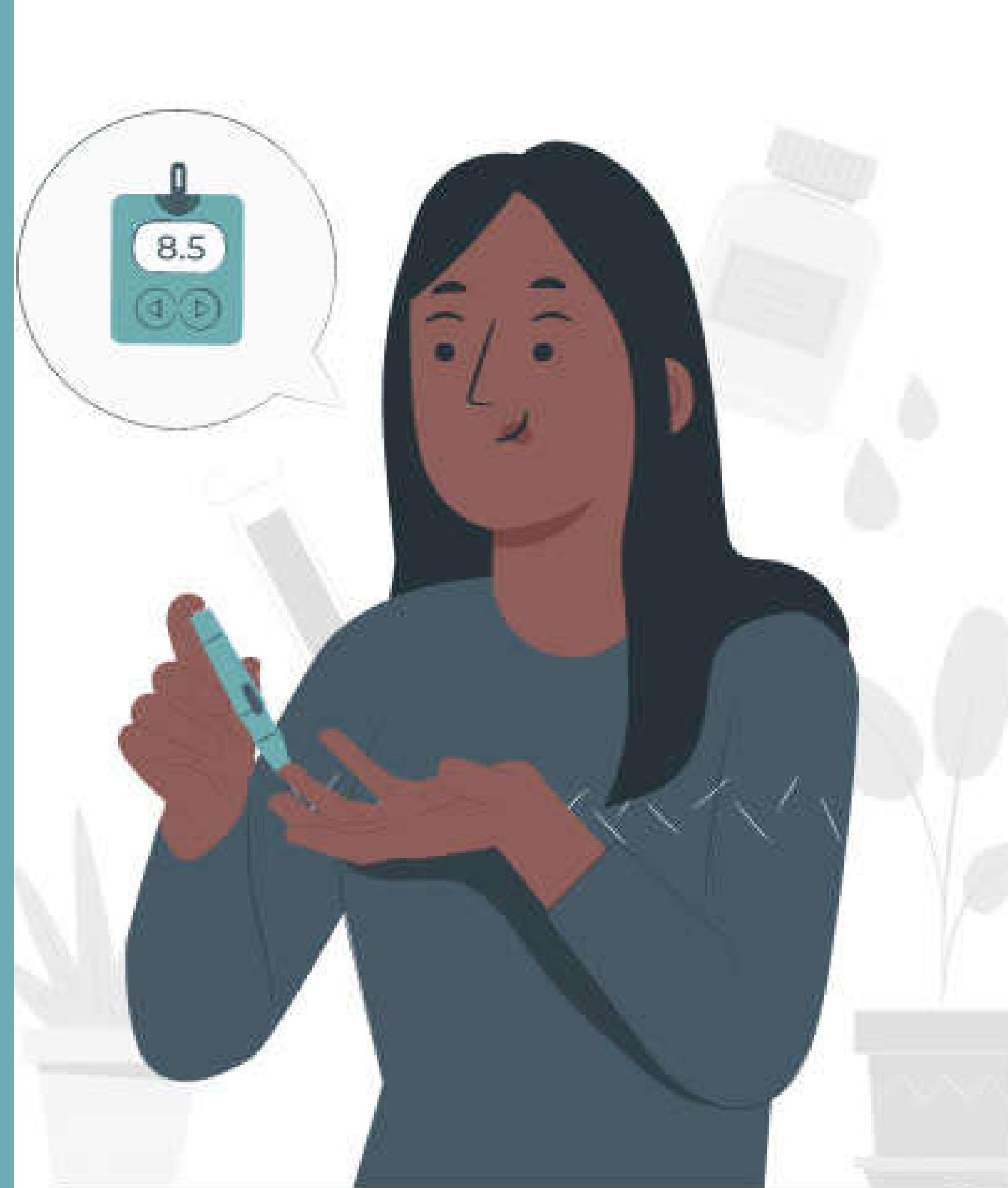
# Class



# Machine Learning



# Diabetes



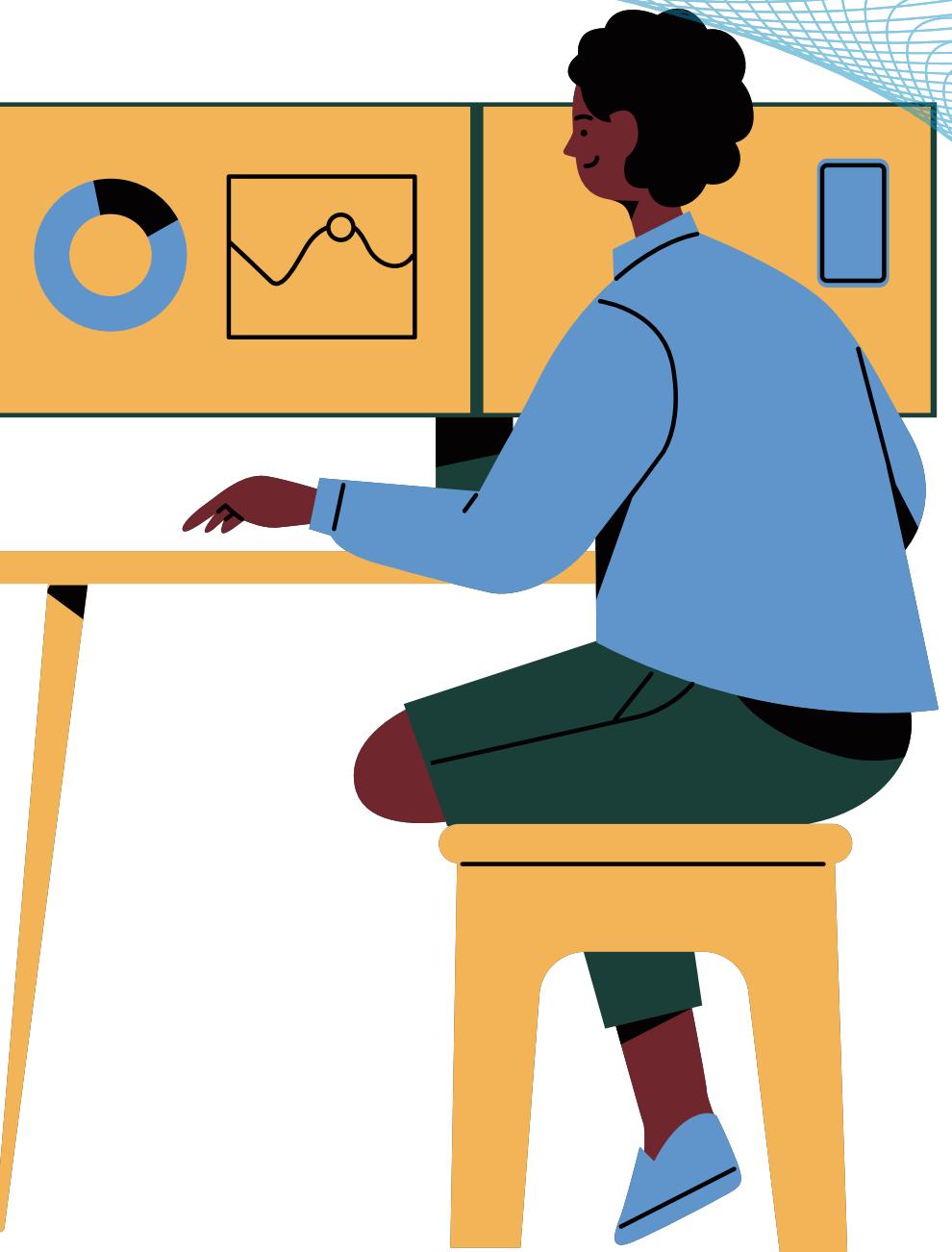
# Diabetes

- According to mayo clinic more than 100 million adults in the United States now living with diabetes or prediates
- Recognising diabetes side effects early makes treatment 90% successful



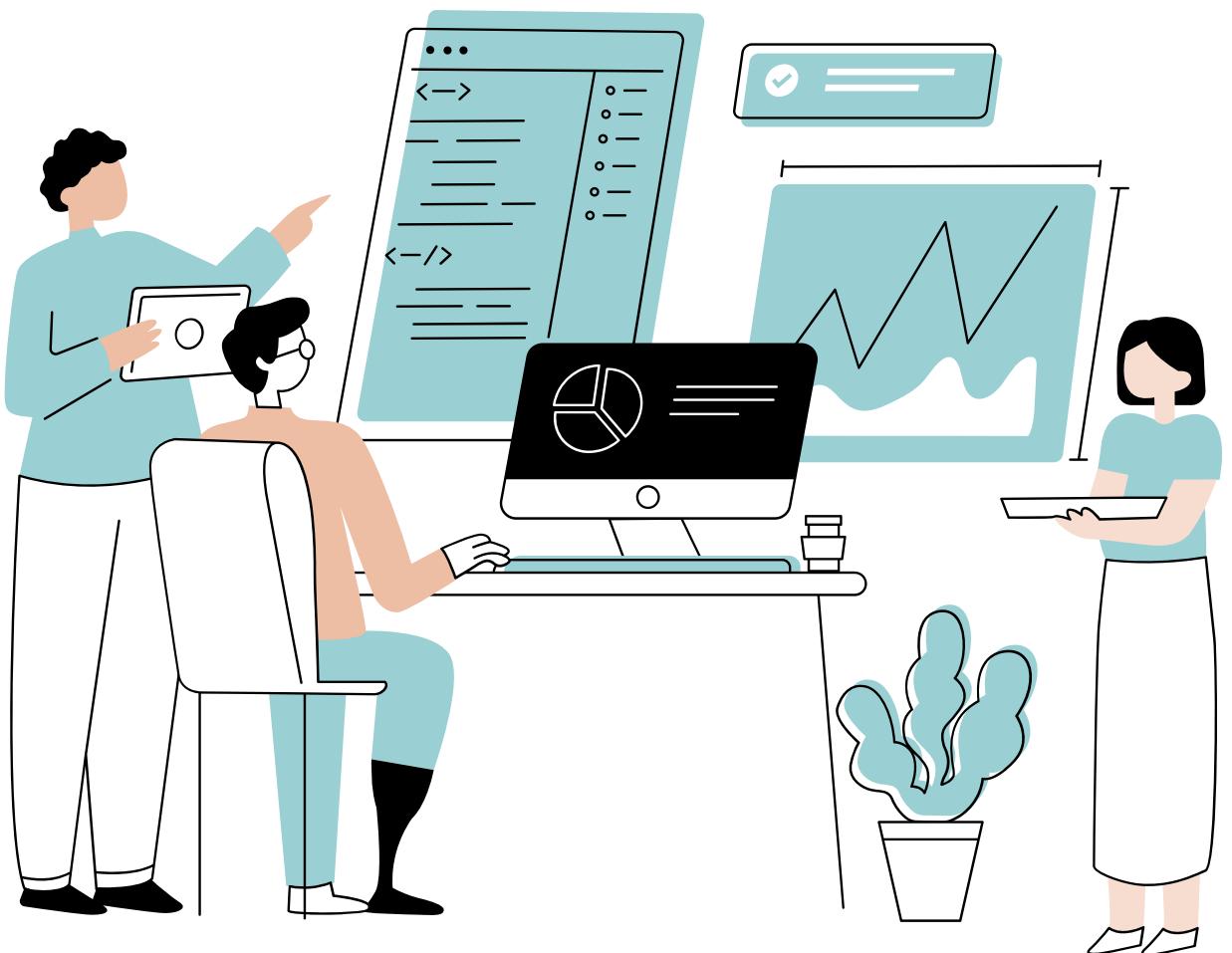
# Dataset

- "Early stage diabetes risk prediction dataset"
- Collected using direct questionnaires from the patients of Sylhet Diabetes hospital in Sylhet, Bangladesh and approved by a doctor
- Data Set Characteristics is multivariate
- Data (250,17)



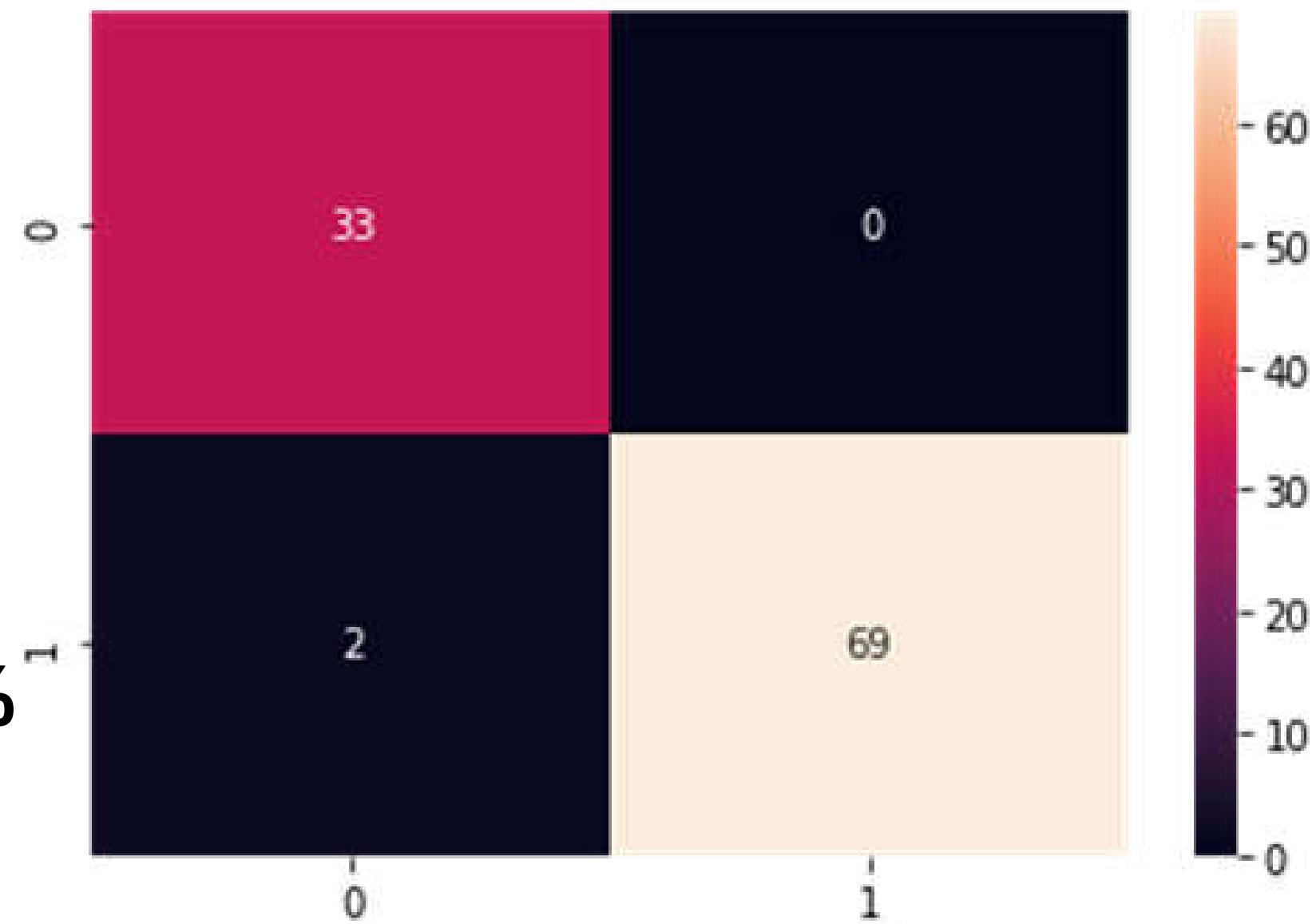
# Data pre-processing

- Check to the null values
- Label Encoder
- Correlation of dataset
- Splitting data 80%, 20%
- Robustscaler



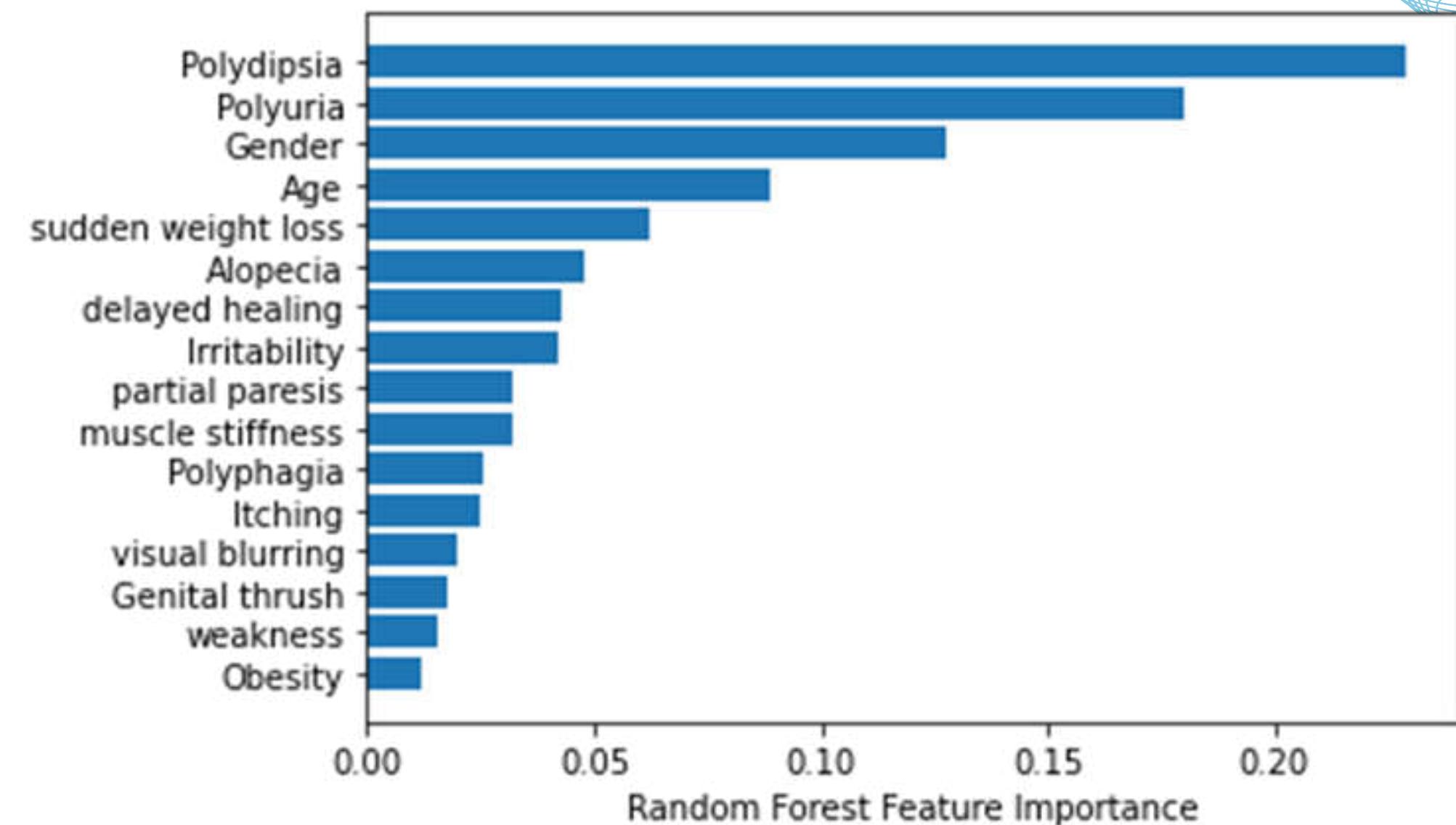
# Accuracy

- Random Forest Algorithm
- Get training score 100% and test score is 98.08%
- F1-score in +ve is 97% and in -ve 99%
- Recall is in +ve is 97% and in -ve 100%
- Precision in +ve is 100% and in -ve 94%



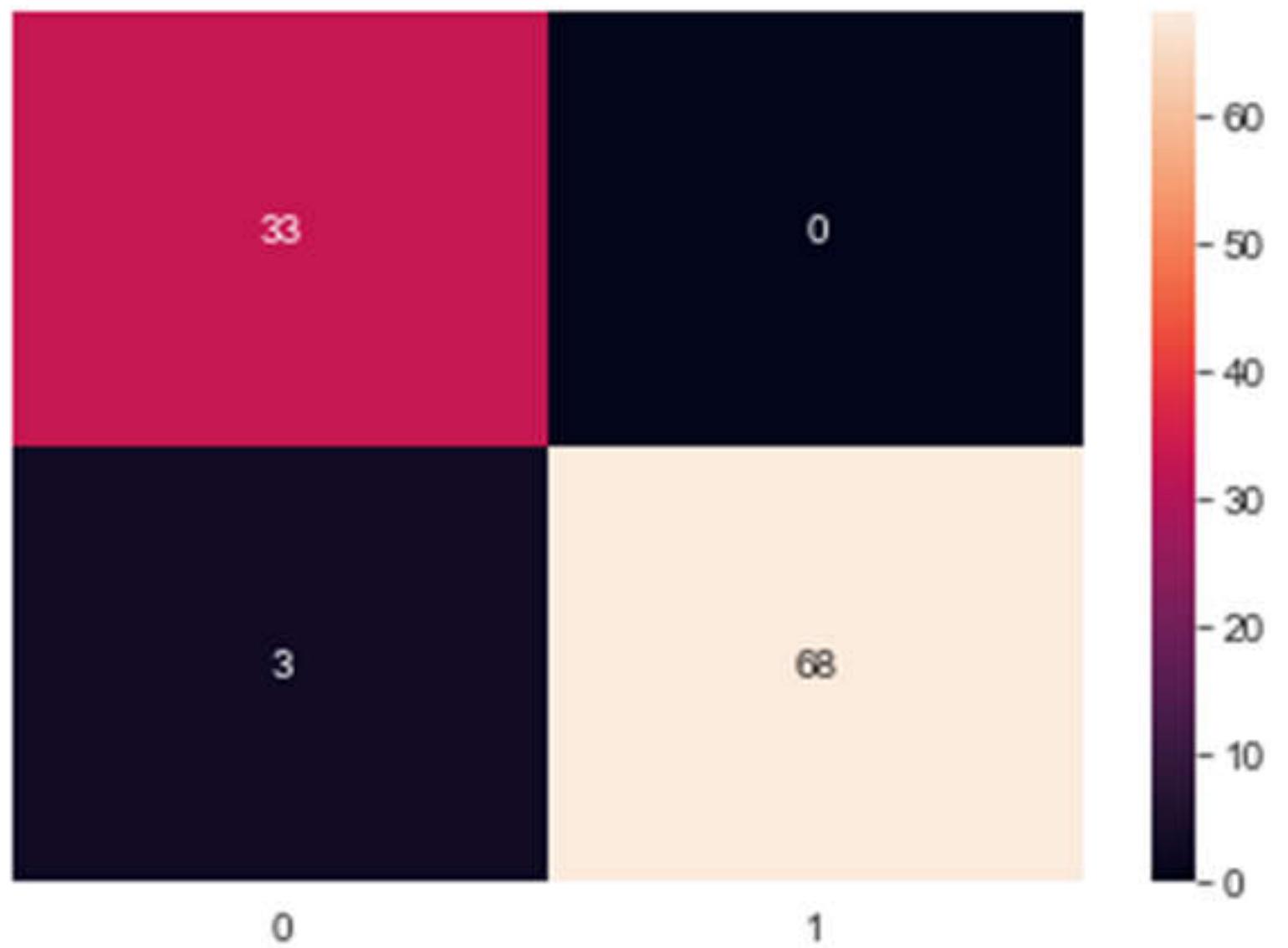
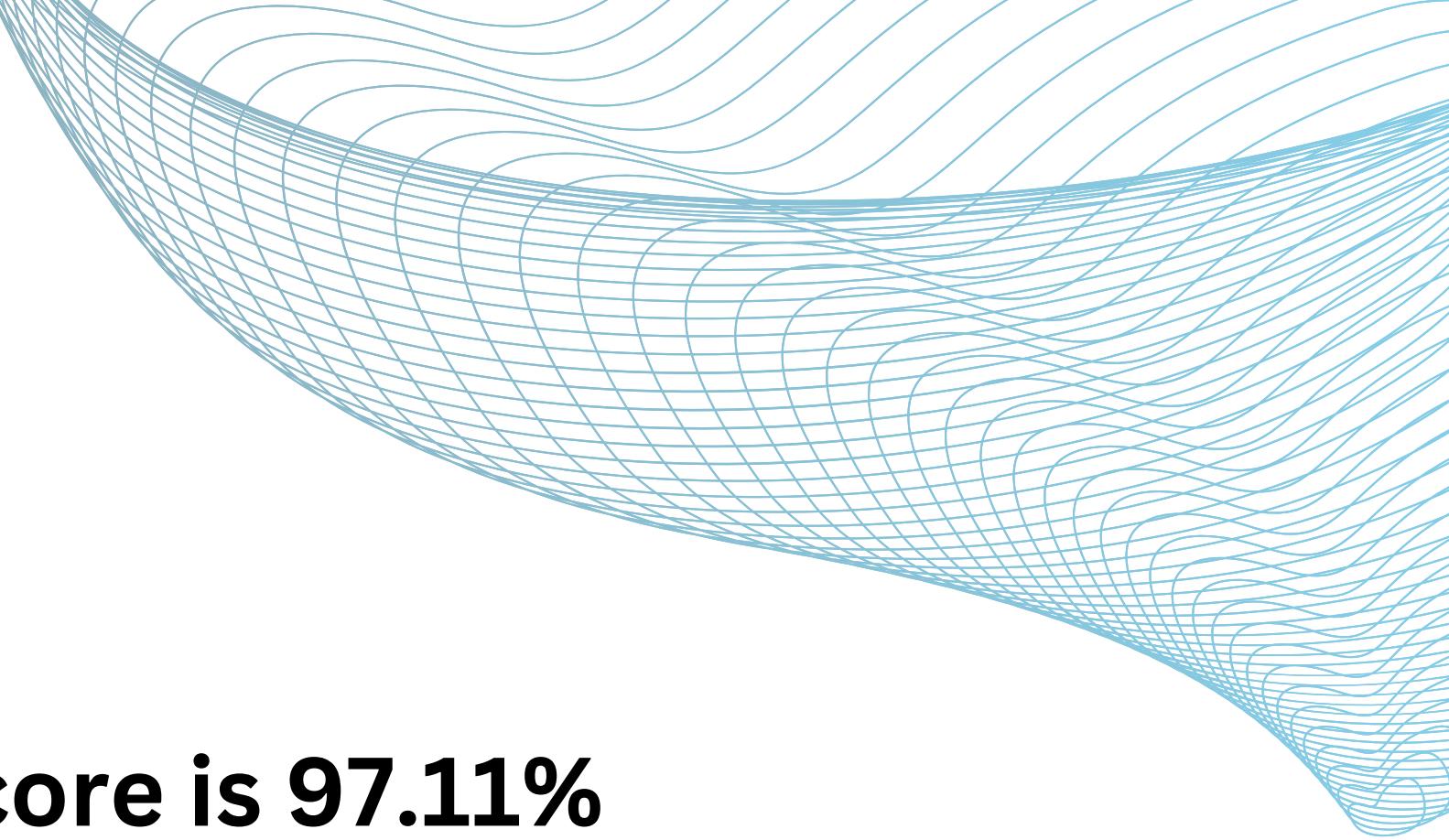
# Feature Importance

Choose top  
**6 features**  
effect on the model



# Modify model

- Random Forest Algorithm
- Get training score is 97.60% and test score is 97.11%
- F1-score in +ve is 98% and in -ve 96%
- Recall is in +ve is 96% and in -ve 100%
- Precision in +ve is 100% and in -ve 92%



# Brain Tumor



# Brain Tumor

A brain tumor, known as an intracranial tumor, is an abnormal mass of tissue in which cells grow and multiply uncontrollably, seemingly unchecked by the mechanisms that control normal cells.



# Dataset

- "Brain Tumor Classification (MRI)"
- Collected images are examined by the radiologist
- Dataset is a images
- Total images is 3,264



# Data pre-processing

- Reshaping pictures to  $150 \times 150$
- One Hot Encoding on the labels
- Splitting data 90%, 10%

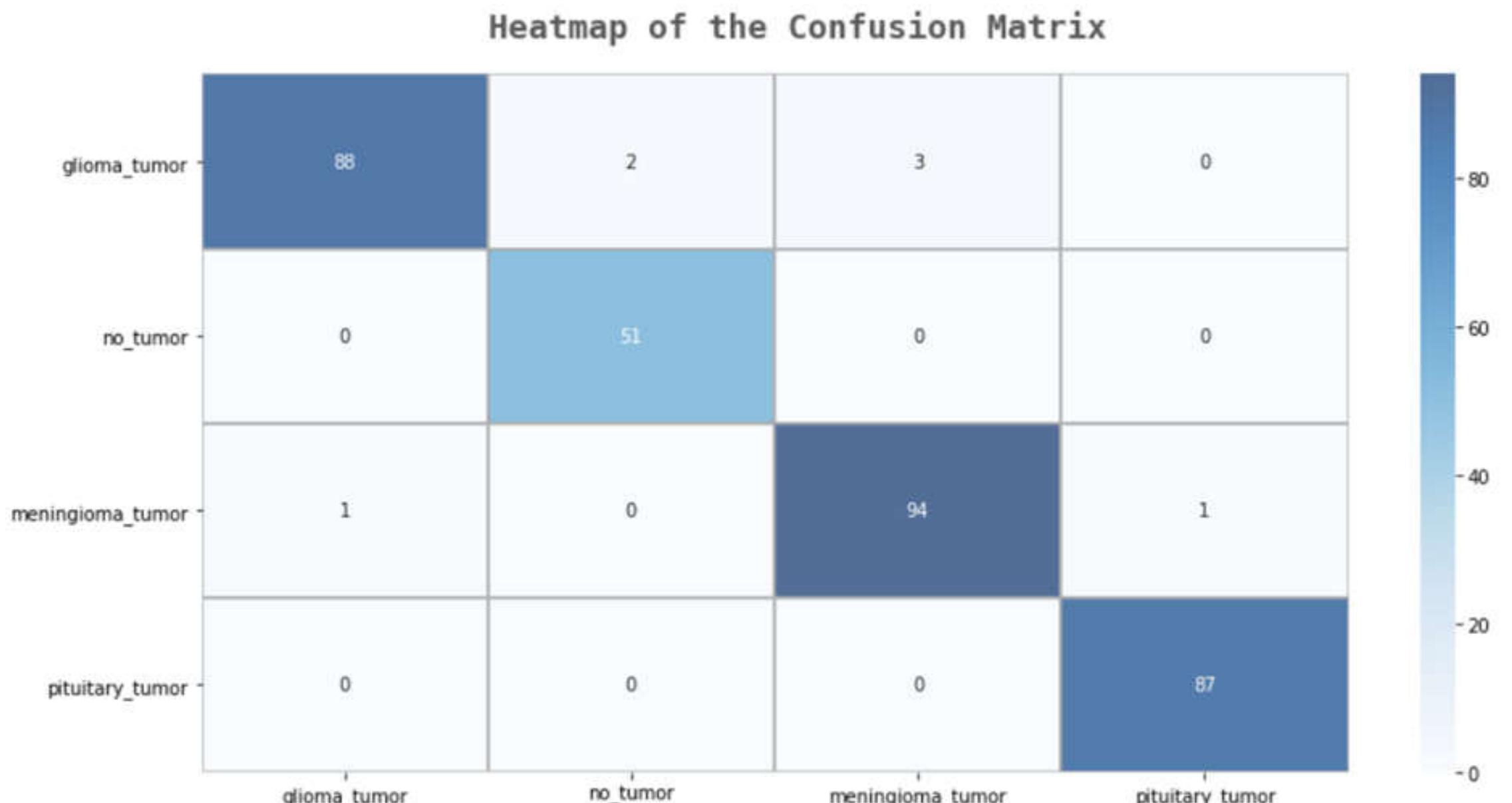


# Transfer Learning

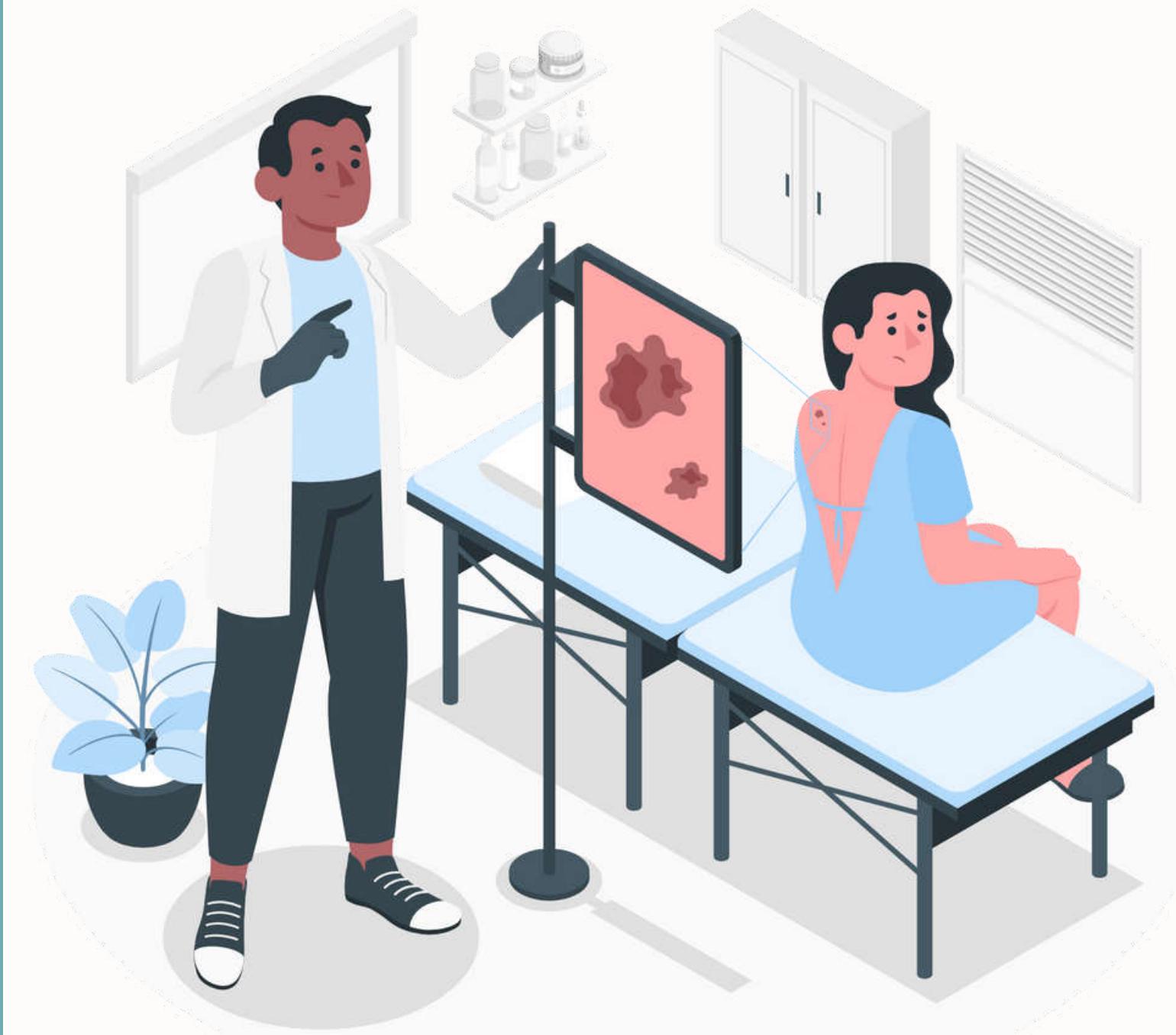
- This technology focuses on reusing pre-trained models for related tasks
- It requires fewer labeled examples for training
- It ensures faster results and enhanced performance.
- Limited to tasks that are related to the source task

# Accuracy

- Get training score 97% and test score is 98%
- F1-score in 97%
- Recall is in 96%
- Precision in 98%



# Skin Cancer



# Skin Cancer

**Skin cancer, the abnormal growth of skin cells most often develops on skin exposed to the sun.**

**But this common form of cancer can also occur on areas of your skin not ordinarily exposed to sunlight.**



# Dataset

- "Skin Cancer MNIST: HAM10000"
- Images Data
- Total images is 10,015



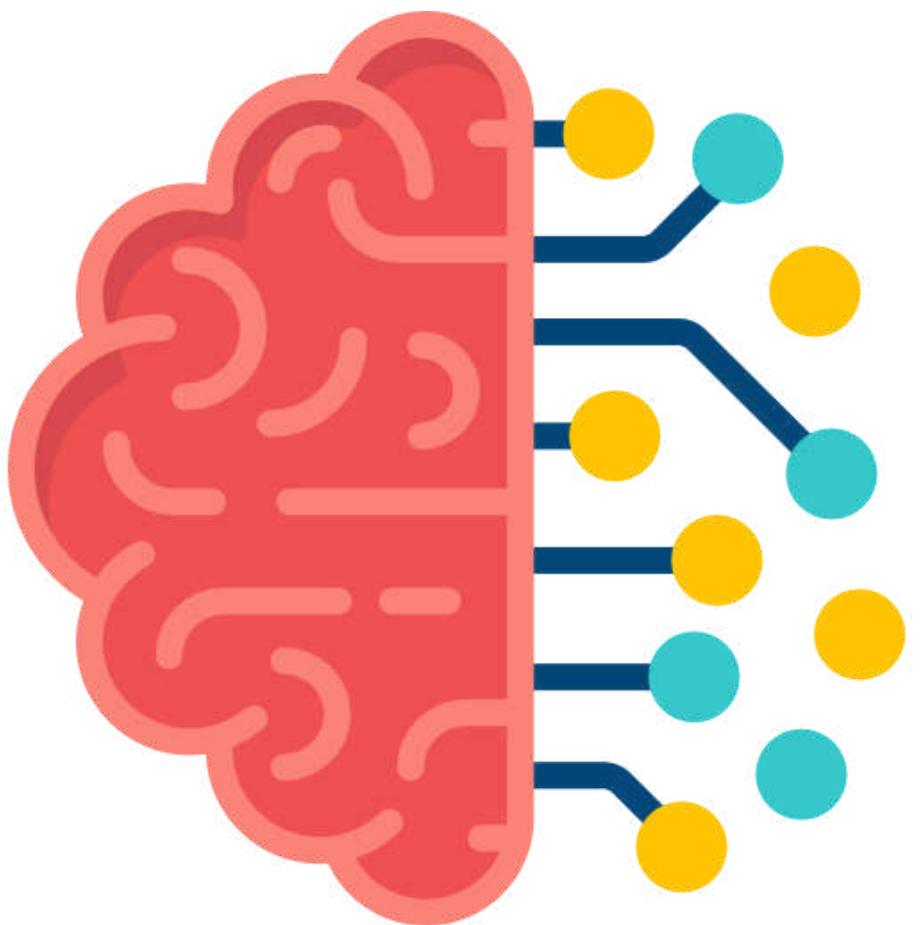
# Data pre-processing

- Splitting data 80% train, 20% test
- Reshaping pictures to  $28 \times 28$
- Normalizing
- Augmentation



# Deep Learning Model

- Using Layers (CNN 2D , Batch normalization , Max pooling2D , Dropout , Flatten , Dense)
- With the last layer being a Dense layer with 7 nodes as it's activation function “Softmax” to output multi-class classification results



# Accuracy

- training score 99% and test score is 98%
- macro AVG 98%
- weighted AVG is 98%

	precision	recall	f1-score	support
nv	0.99	0.88	0.93	1385
mel	0.94	0.99	0.97	1328
bkl	0.95	1.00	0.97	1294
bcc	0.99	1.00	1.00	1325
akiec	1.00	1.00	1.00	1278
vasc	1.00	1.00	1.00	1293
df	1.00	1.00	1.00	1257
accuracy			0.98	9152
macro avg	0.98	0.98	0.98	9152
weighted avg	0.98	0.98	0.98	9152

# Pneumonia

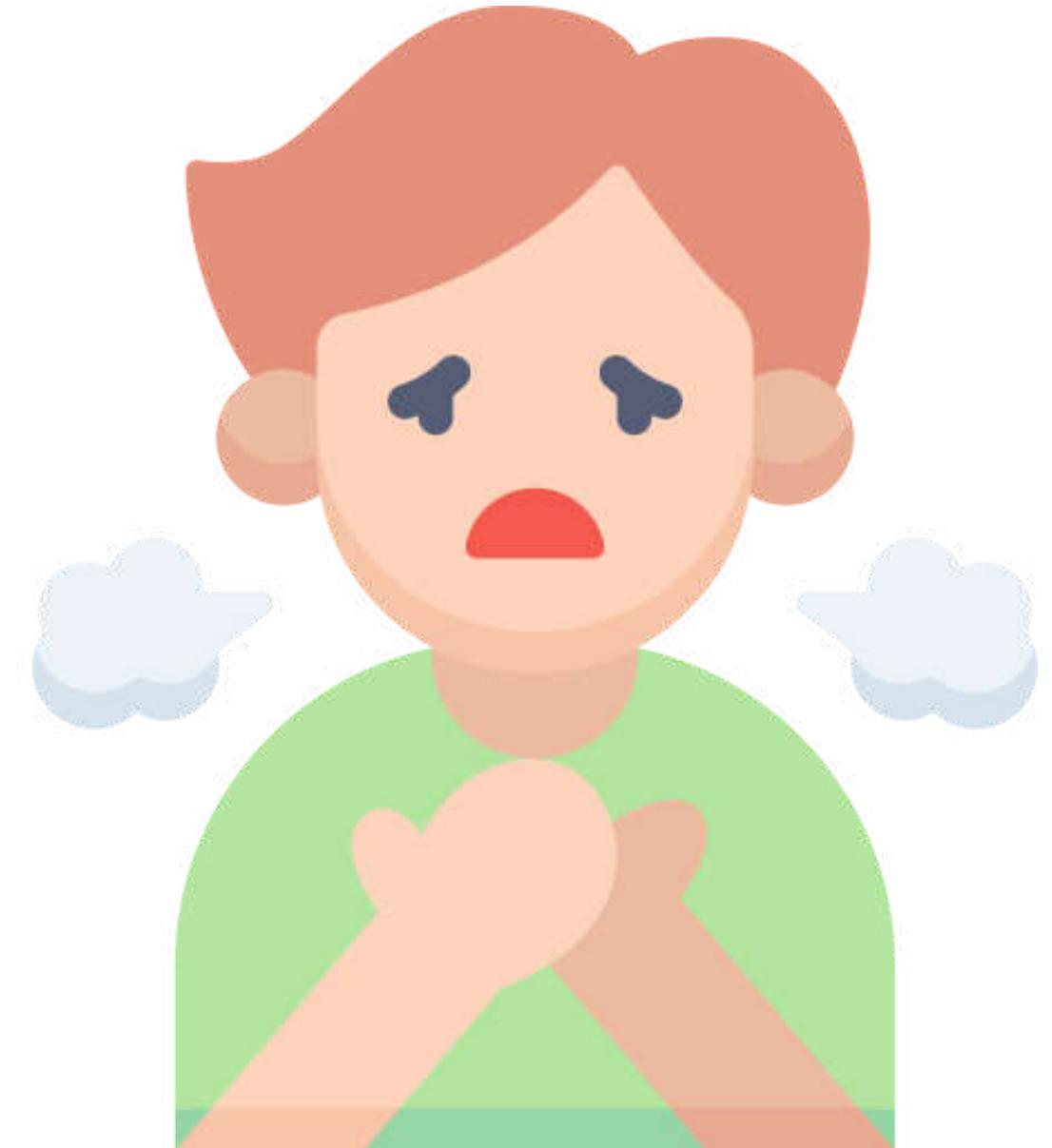
## Chest (x-ray)



# Pneumonia

**Pneumonia is an inflammatory condition of the lung affecting primarily the small air sacs include dry cough, chest pain, fever and difficulty breathing.**

**Risk factors include diabetes, heart failure, a history of smoking, a poor ability to cough such as following a stroke and a weak immune system.**



# Dataset

- "Chest X-Ray Images (Pneumonia)"
- Images Data
- Total images is 5,840



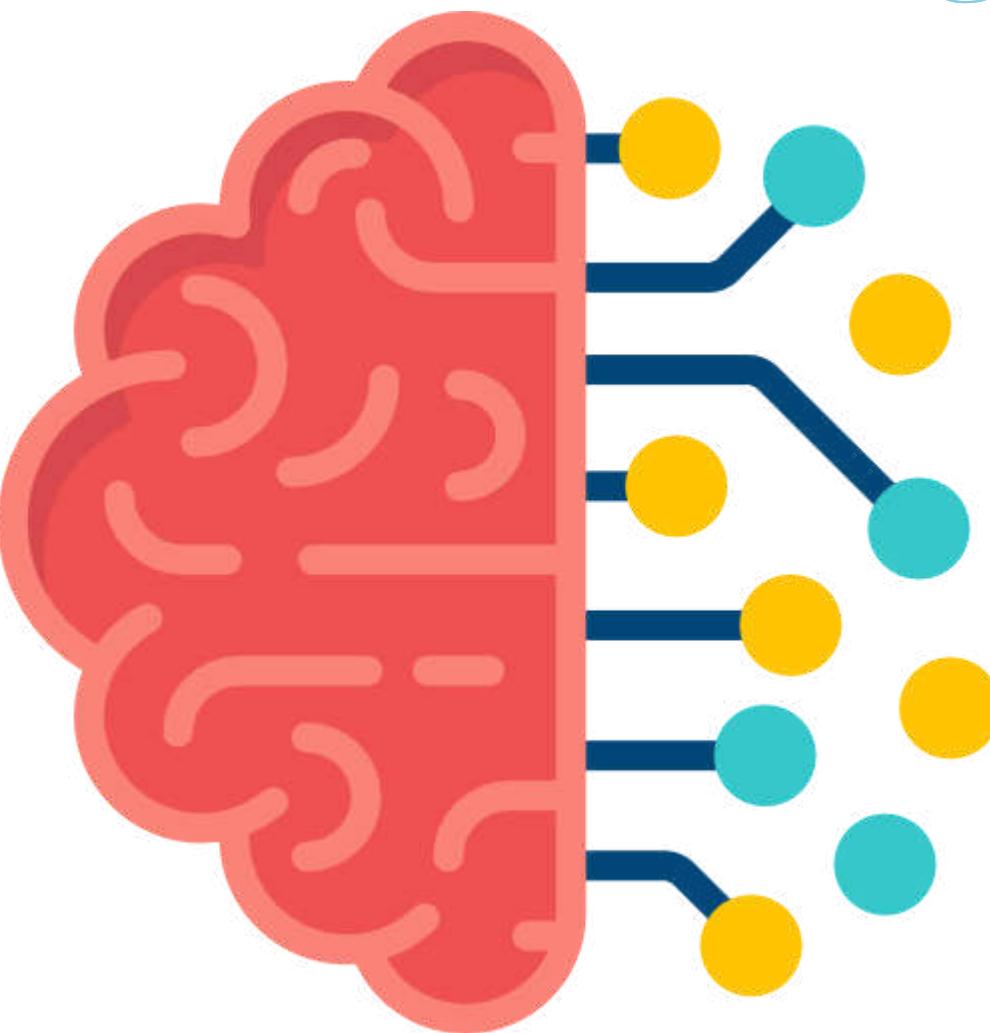
# Data pre-processing

- Splitting data 80% train, 20% test and 15 images as validation
- Reshaping pictures to 150 x 150
- Normalizing
- Augmentation



# Deep Learning Model

- Using Layers (CNN 2D , Batch normalization , Max pooling2D , Dropout , Flatten , Dense)
- With the last layer being a Dense layer with one node as it's activation function “Sigmoid” to output binary classification result (positive or negative)



# Accuracy

- training score 93% and test score is 92.6%

- F1-score is 94%

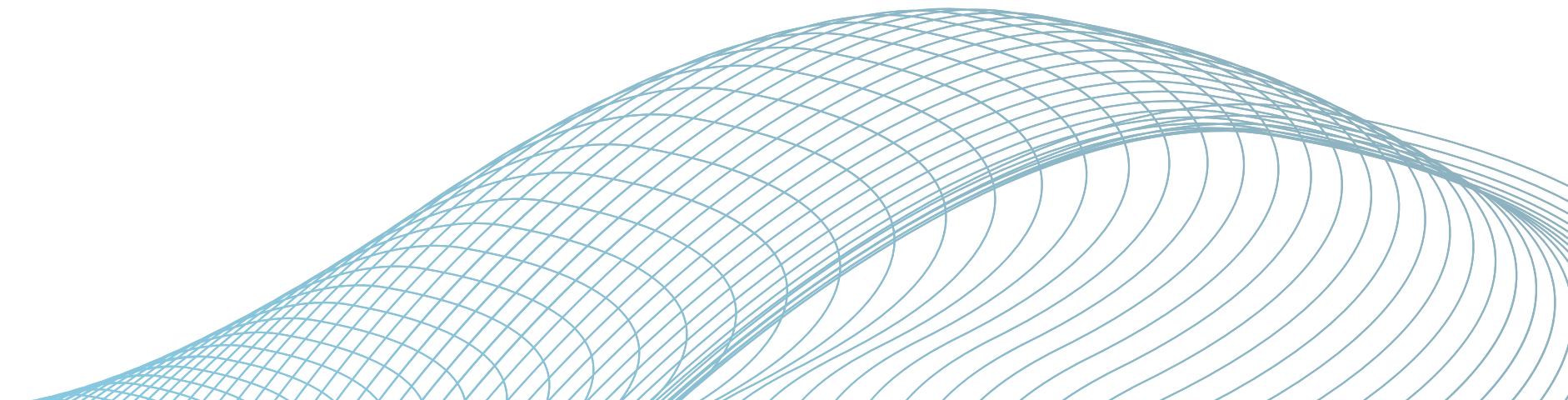
- Recall is in 95%

- Precision in 93%

	precision	recall	f1-score	support
Pneumonia (Class 0)	0.93	0.95	0.94	398
Normal (Class 1)	0.92	0.88	0.90	234
accuracy			0.93	624
macro avg	0.92	0.92	0.92	624
weighted avg	0.93	0.93	0.93	624

# Backend

- ML API ([FastApi](#))
- Authentication ([flask](#))

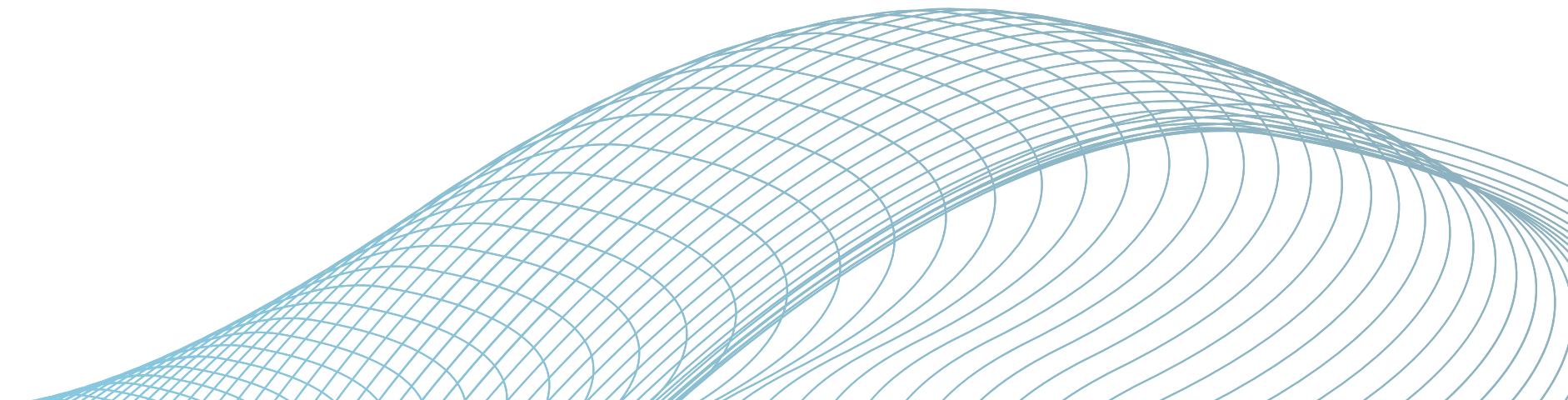
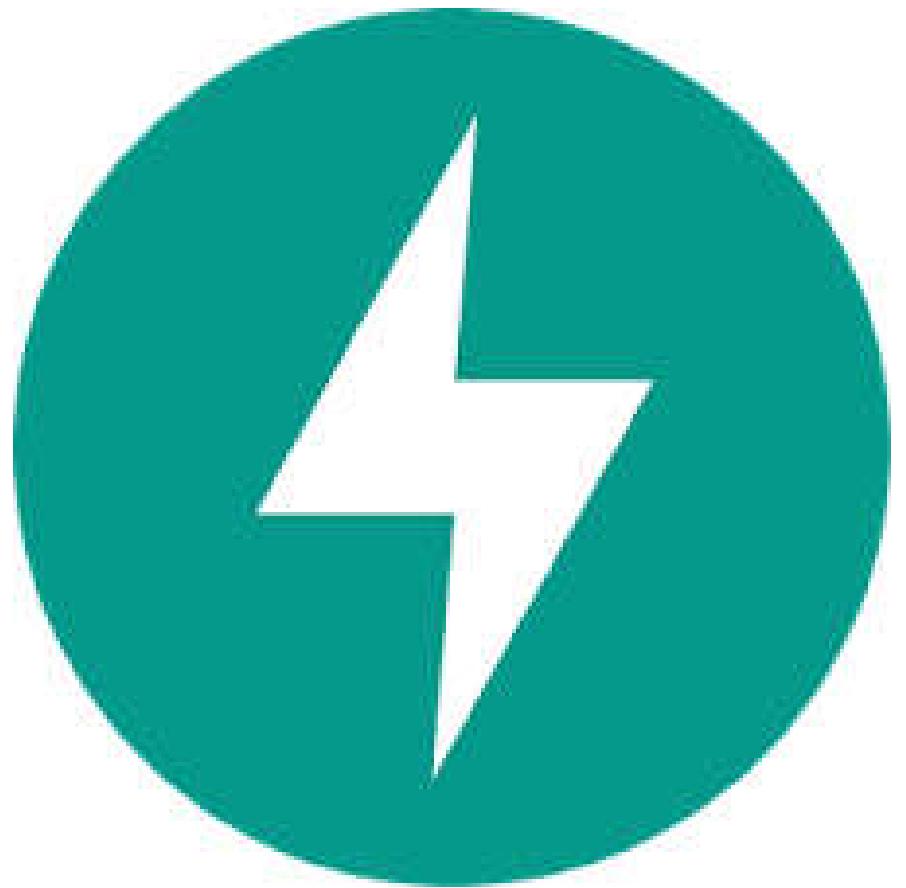


# ML API

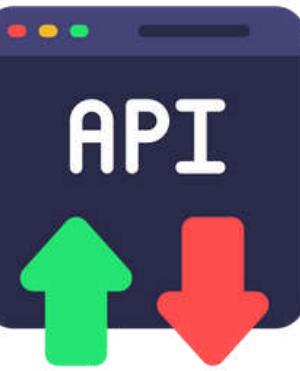


## Why FastAPI:

- **Fast**
- **Ease of use**
- **API documentation and testing**

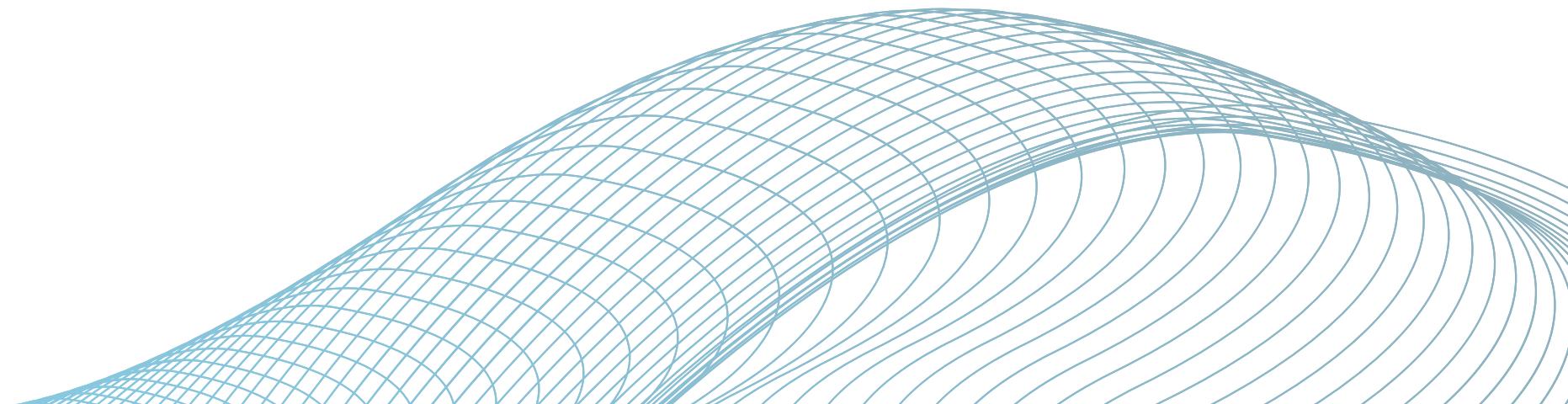


# ML API

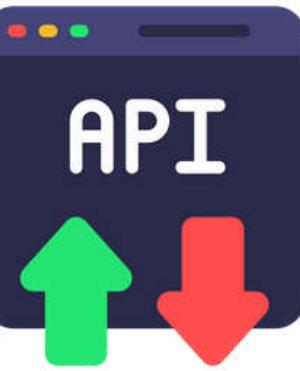


**Python libraries used:**

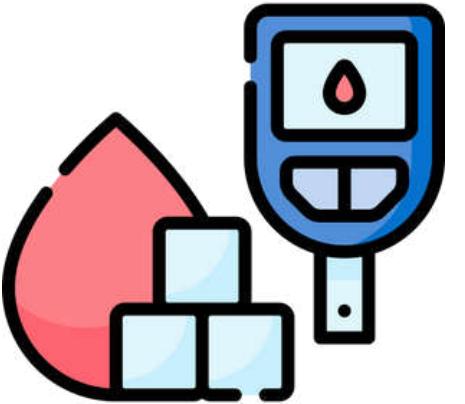
- Fastapi
- Tensorflow
- PIL
- Numpy
- Uvicorn



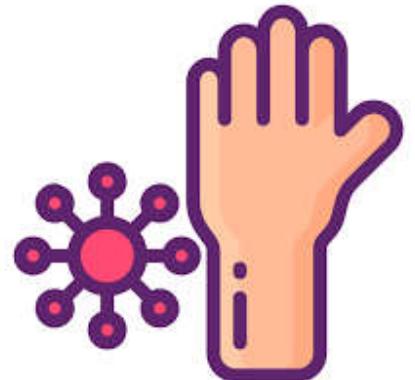
# *Endpoints and their functionality*



- '/diabetes\_prediction'



- '/skin\_cancer\_predict'



- '/chest\_predict'

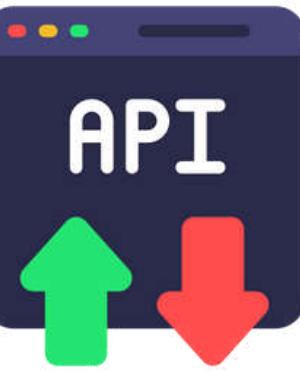
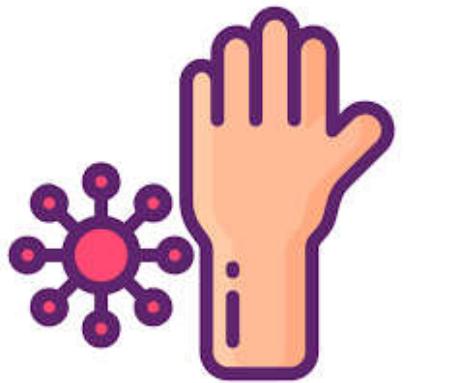
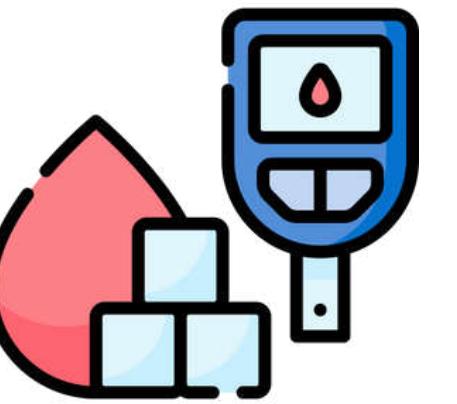


- '/brain\_tumor\_predict'



# *What API do*

- Diabetes prediction
- Skin cancer prediction
- Brain tumor prediction
- Chest X-ray prediction





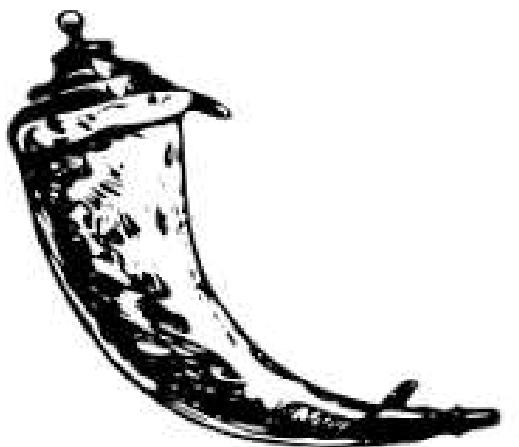
# Authentication

- **What is Flask?**

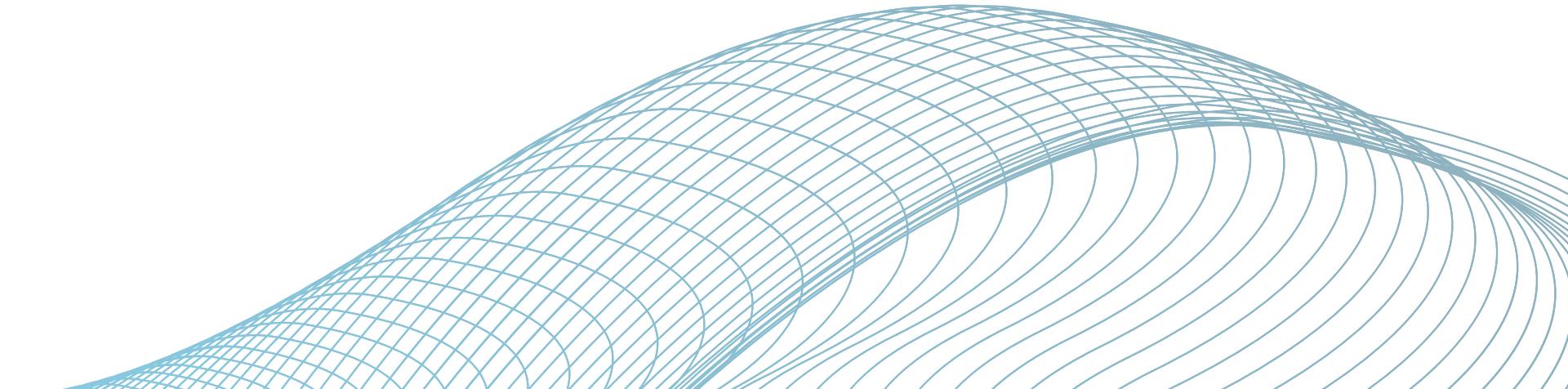
flask is a popular web framework for python that is often chosen for developing web applications

- **Why Flask?**

- Smiplicity
- lightweight
- Extensibility

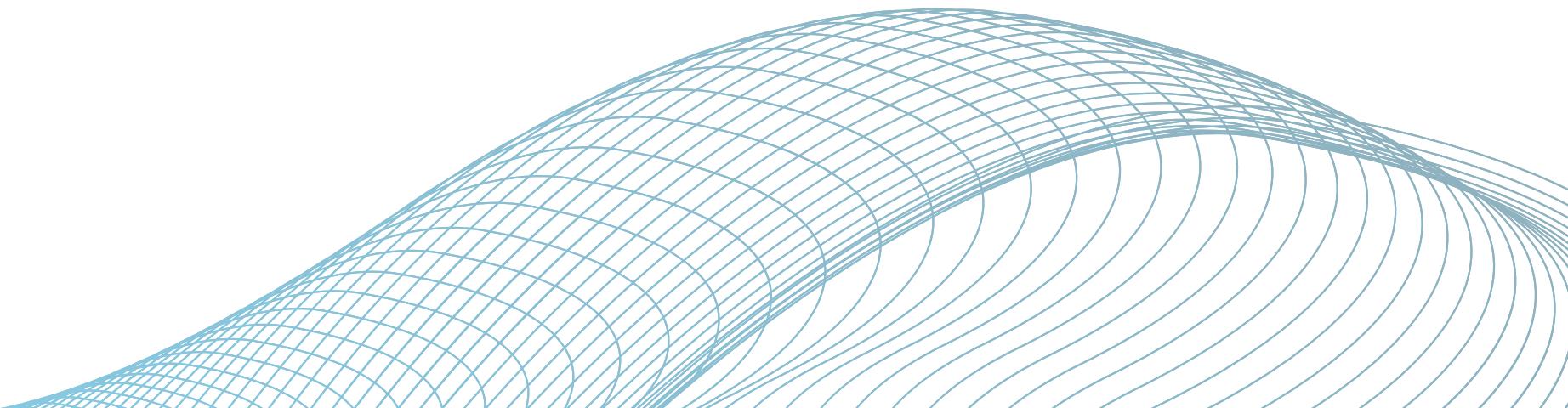


Flask



# Used libraries

- flask
- flask\_Login
- email\_validator



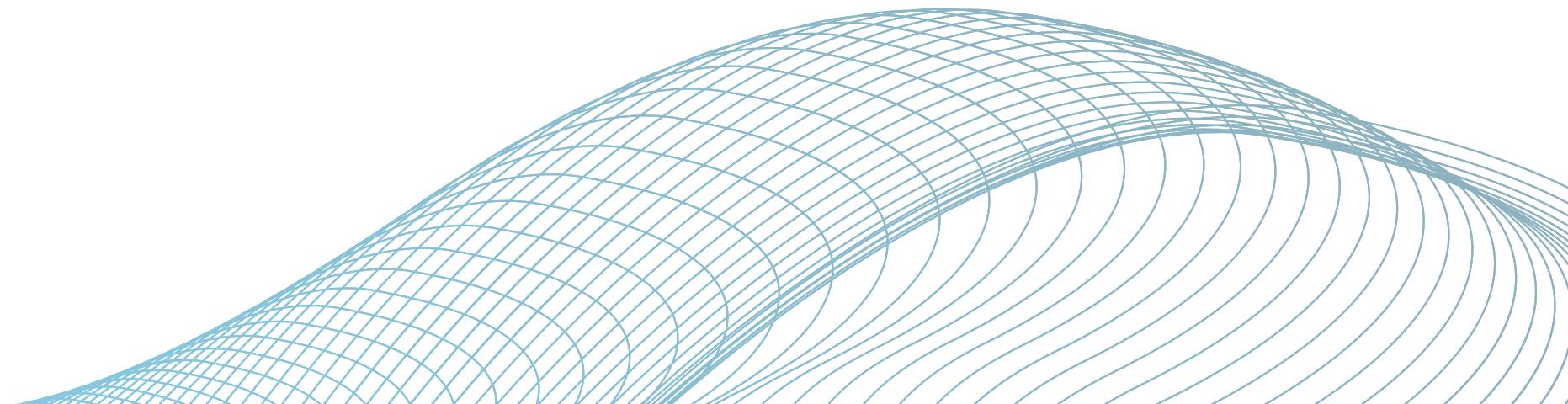


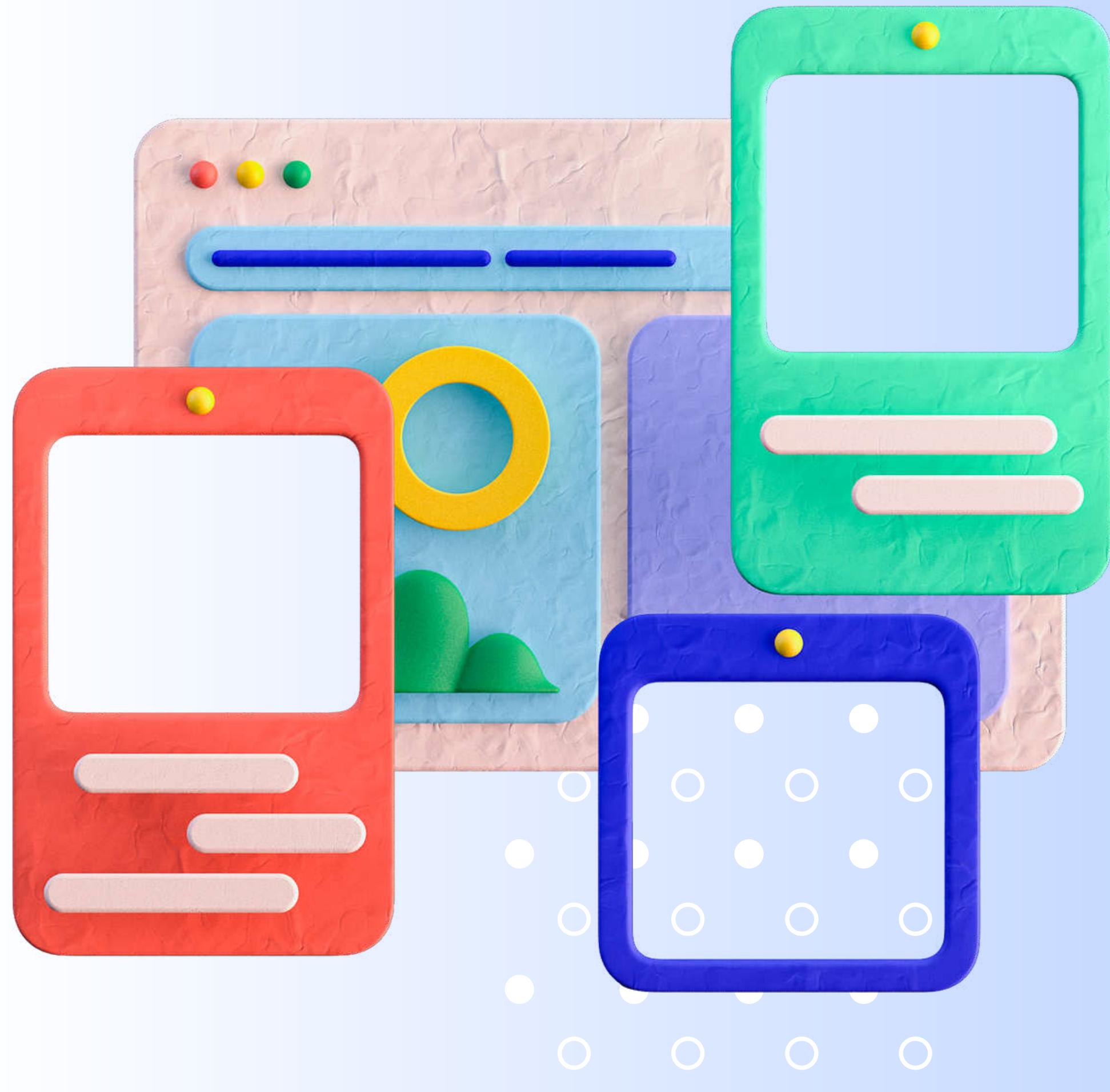
# Signup restrictions

- Check email validation
- Check Name
- Password

# Login restrictions

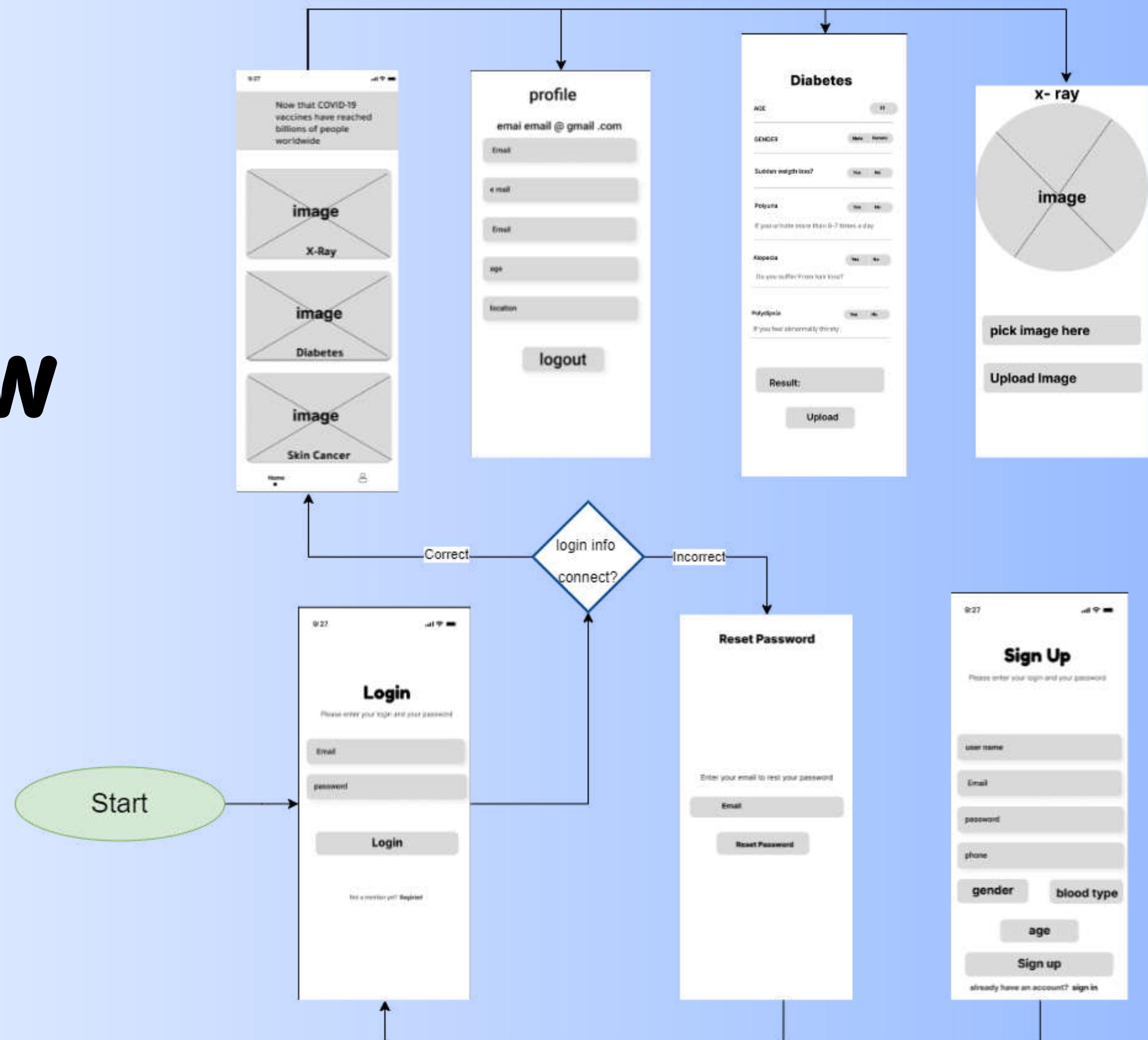
- login decorator
- check email
- password



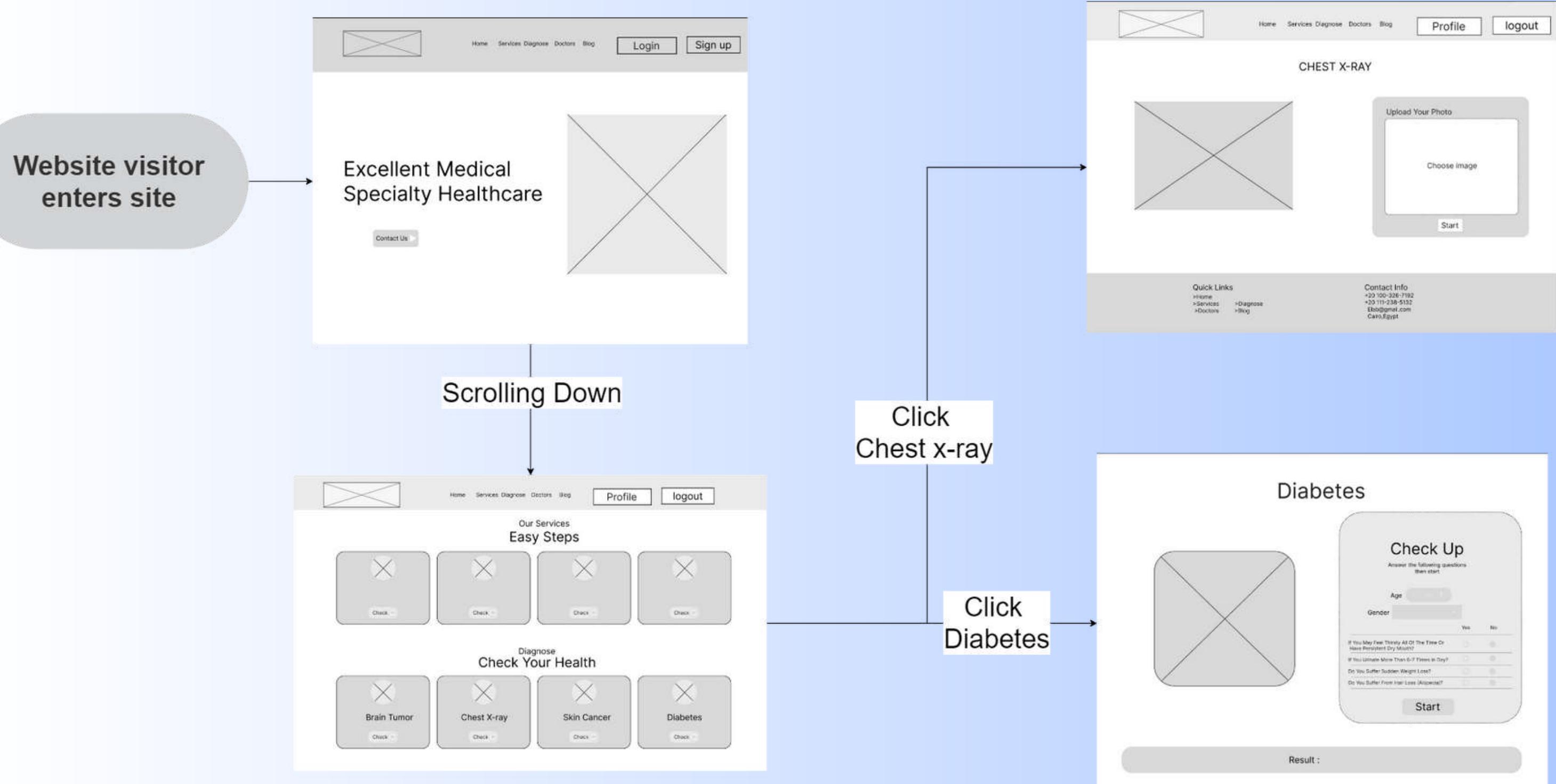


UI/UX

# App User Target Flow



# Website User Target Flow



# Mockup

#000000

#D2D2D2

#6DADB1

#FFFFFF

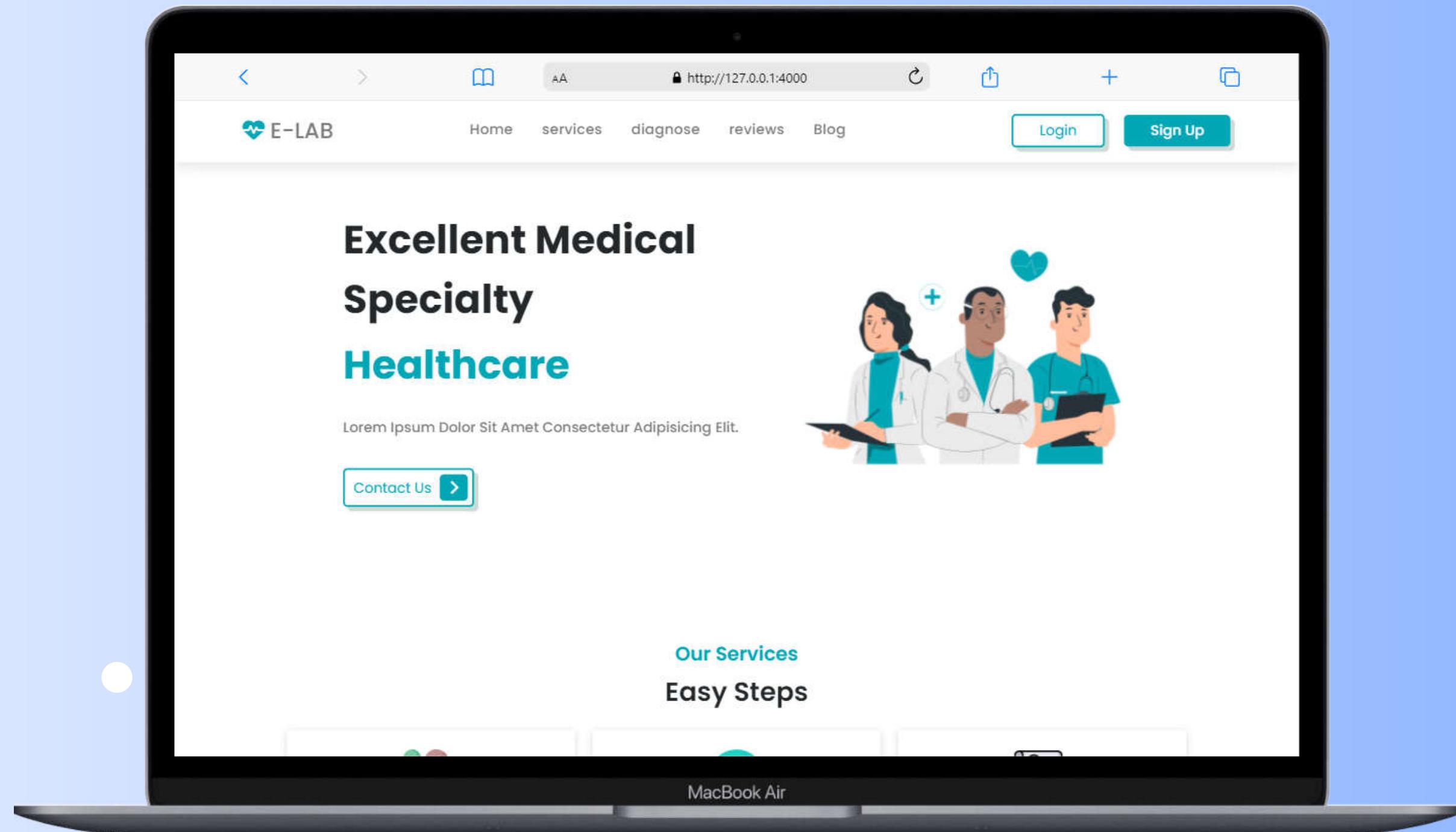
Aa

Roboto Regular

Aa

Roboto Bold

# Frontend



# Languages

HTML



HTML

CSS



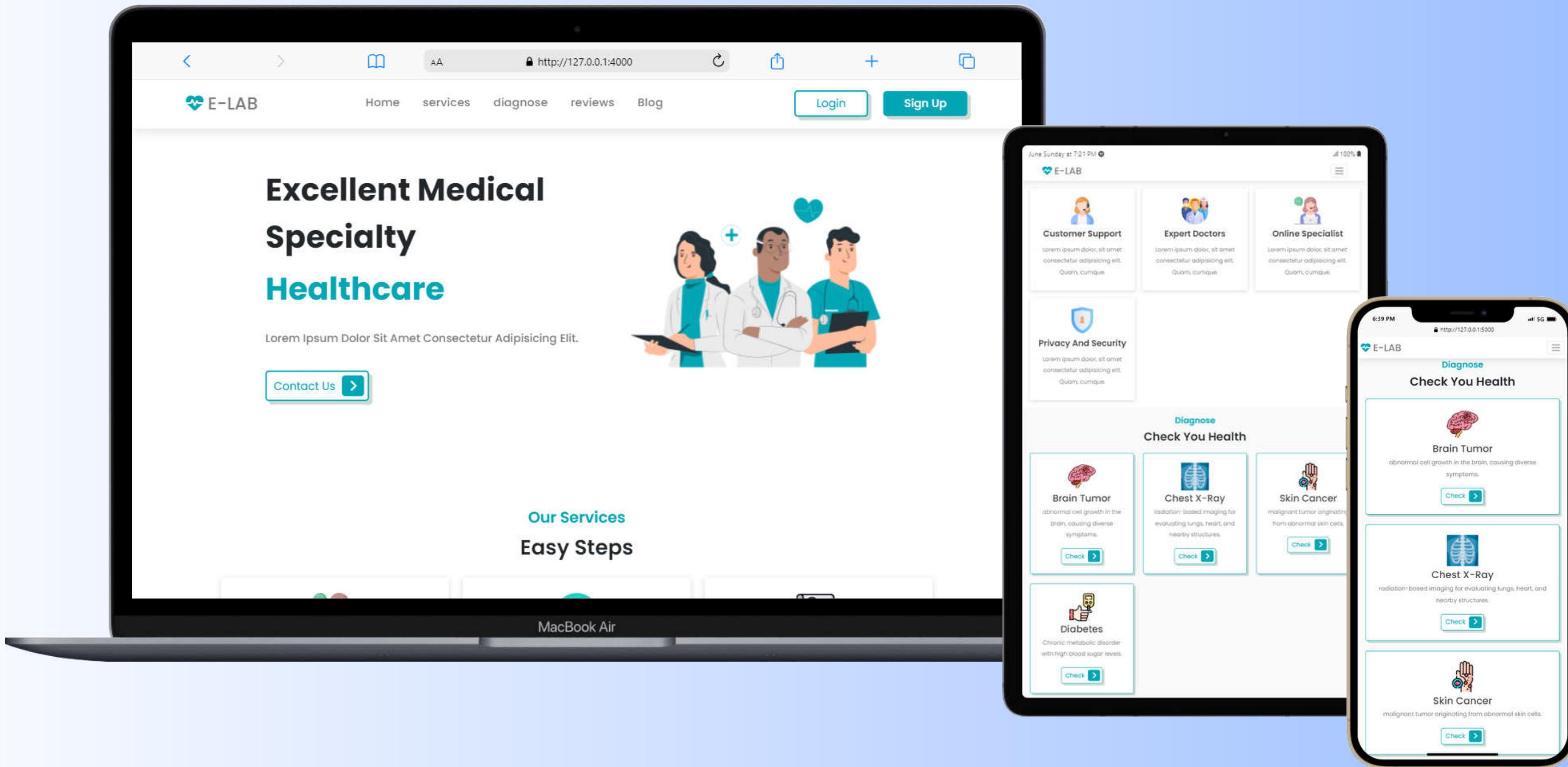
CSS

JS

JavaScript



# Responsivity



# Clear Notify System

Interactive

Understandable



# Error 404 page

Incorrect URL

Server  
Configuration



# Clean Code



1 DRY

2 Meaningful Naming

3 Testability

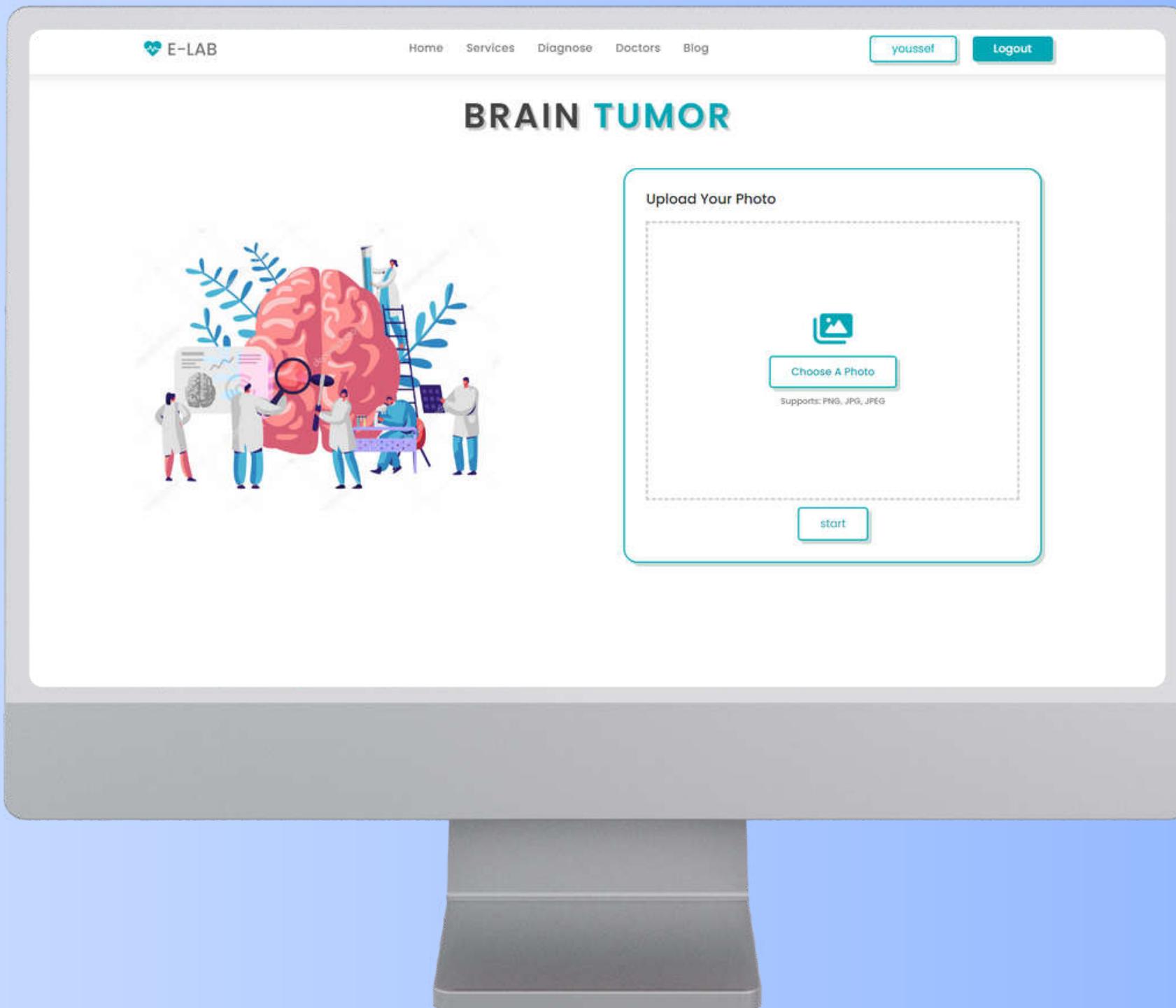
4 Improved Maintainability

5 Improved Team Productivity

# Diseases screens

- Brain – x-ray – skin cancer

- 1- Select and upload image
- 2- check image before sending
- 3- Image sent in binary format
- 4- get the result
- 5- display result to user



# Diseases screens

- Diabetes

**1- Six Features**

**2- Check all fields**

**3- send Data collected from form**

**4- get the result**

**5- display result to user**

The screenshot shows a web interface for a diabetes screening tool. At the top, there's a navigation bar with links for Home, Services, Diagnose, Doctors, and Blog. On the far right, there are buttons for 'youssef' (logged in user) and 'Logout'. The main title 'DIABETES' is centered above a 'Check Up' section. This section contains a heading 'Answer The Following Questions Then Start.', followed by a 'Age' input field, a 'Gender' dropdown menu set to 'Please Select\*', and two radio buttons for 'Yes' and 'No' under each of four listed symptoms: 'If You May Feel Thirsty All Of The Time Or Have Persistent Dry Mouth?', 'If You Urinate More Than 6-7 Times In Day?', 'Do You Suffer Sudden Weight Loss?', and 'Do You Suffer From Hair Loss (Alopecia)?'. A large blue button labeled 'start' is located at the bottom right of the 'Check Up' box. To the left of the form, there's a graphic illustration featuring a hand holding a test strip over a digital glucose meter displaying '950', a small bottle of pills, and a circular icon containing a microscopic view of a cell.

# Testing

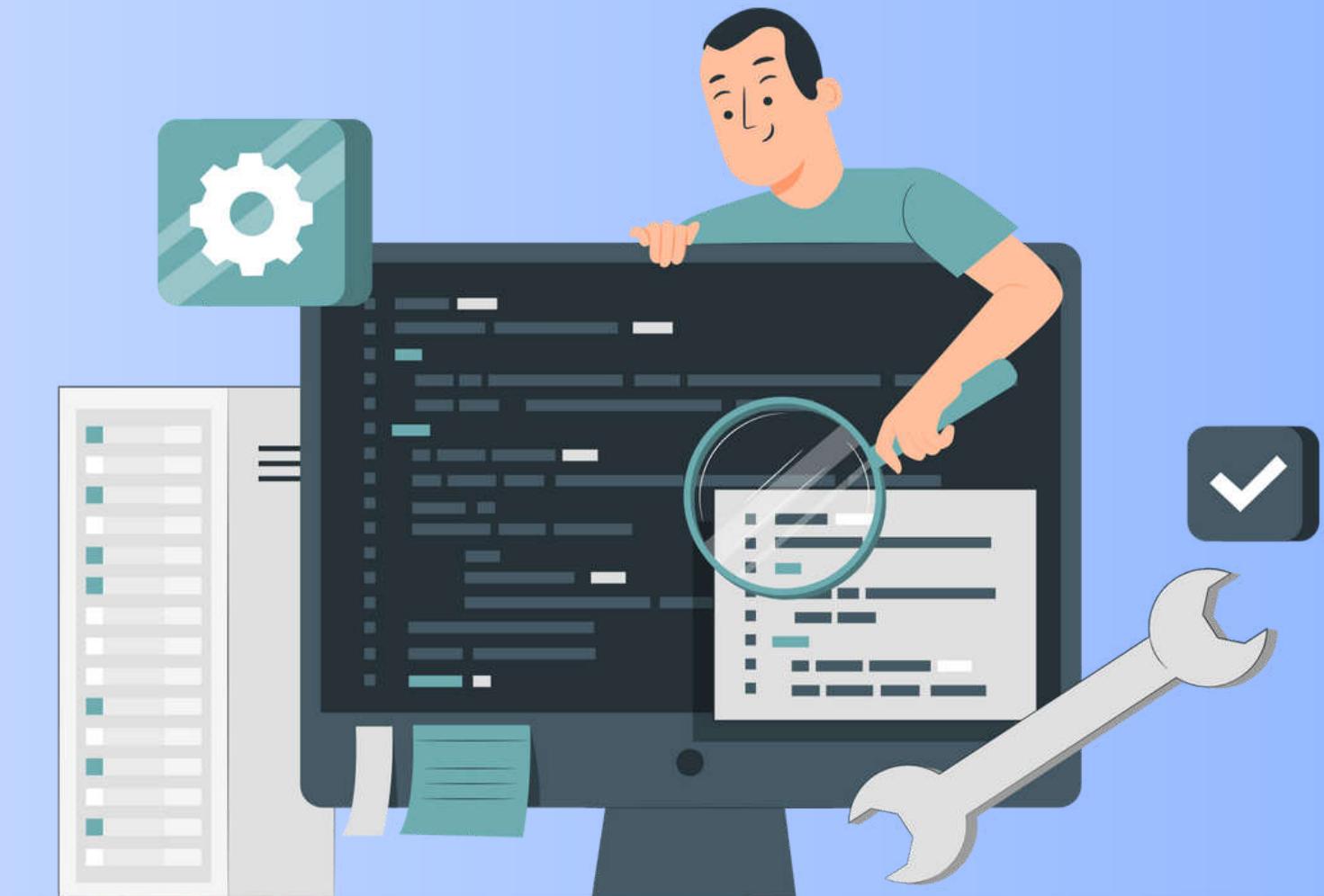


POSTMAN

Test API using Postman



Project tested using jest test



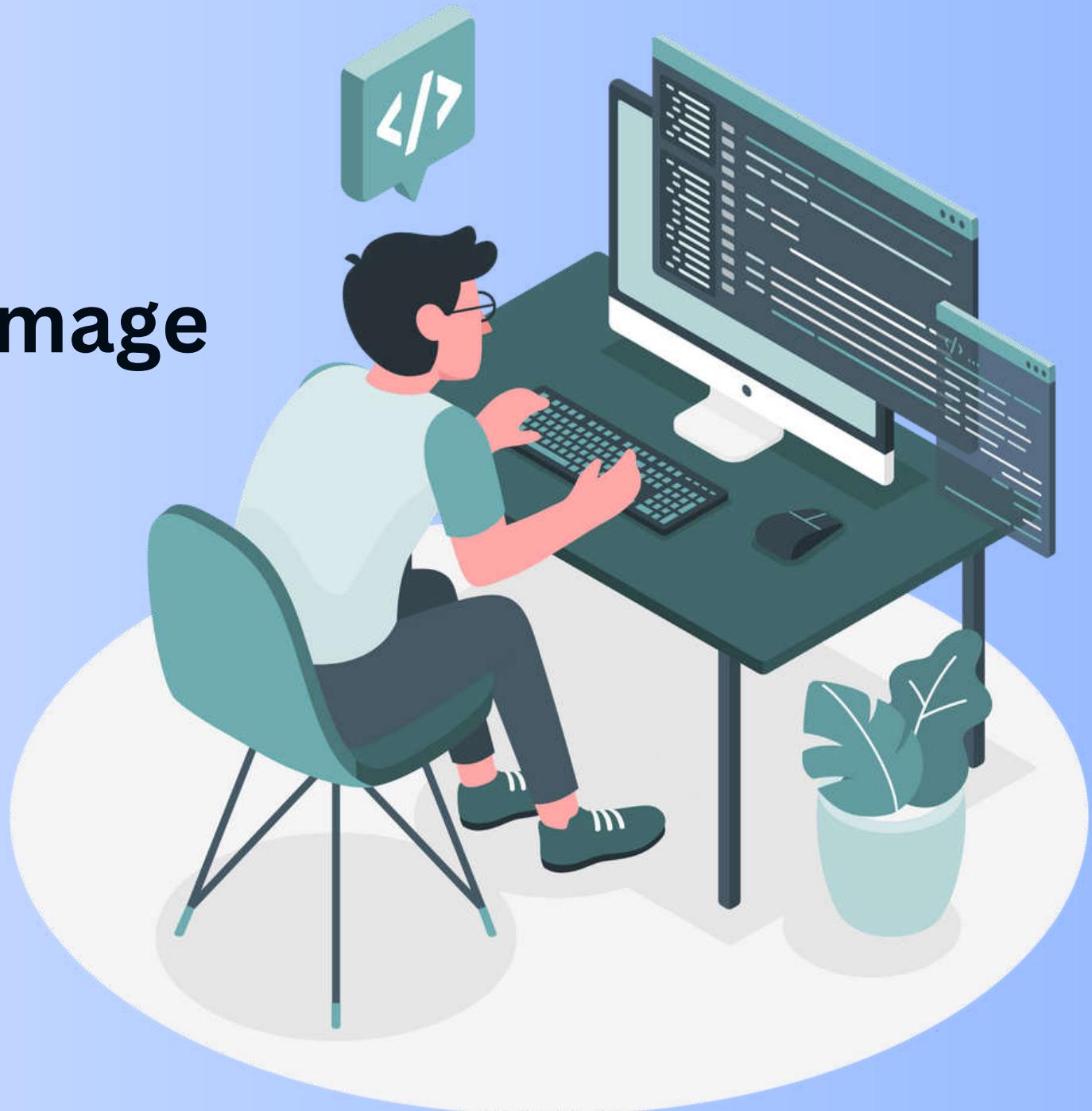
# Availability



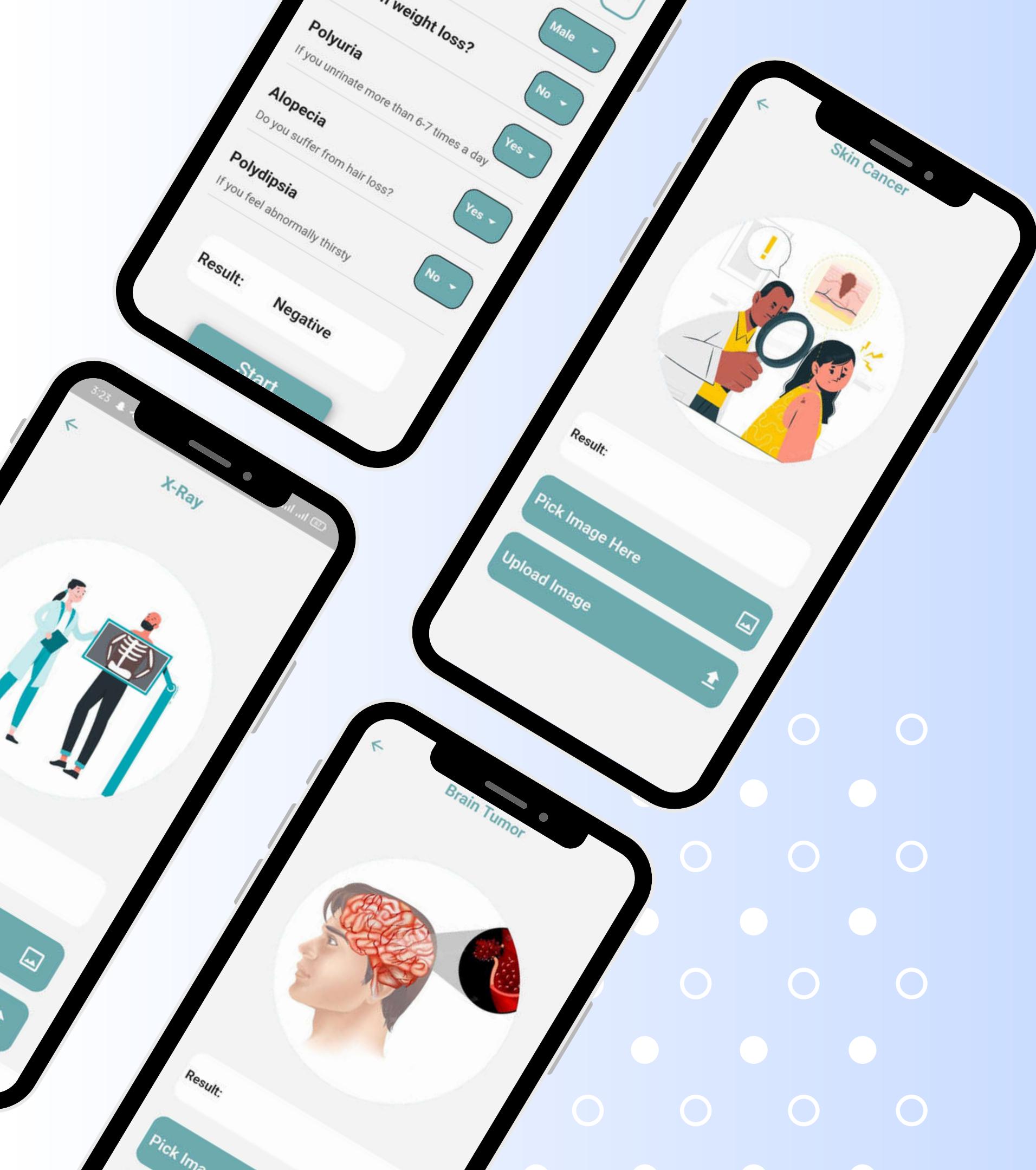
**The project is available as a docker image**



**Source code is available on GITHUB**



# MOBILE APPLICATION



# What is



# Flutter

1

Open-Source Framework

2

Dart



# Why

# Flutter

1

Cross Platform

2

Fast Development

3

Cheap

4

Performance

# Sign Up

Please enter your login and your password

 user name

 Email

 password

 phone

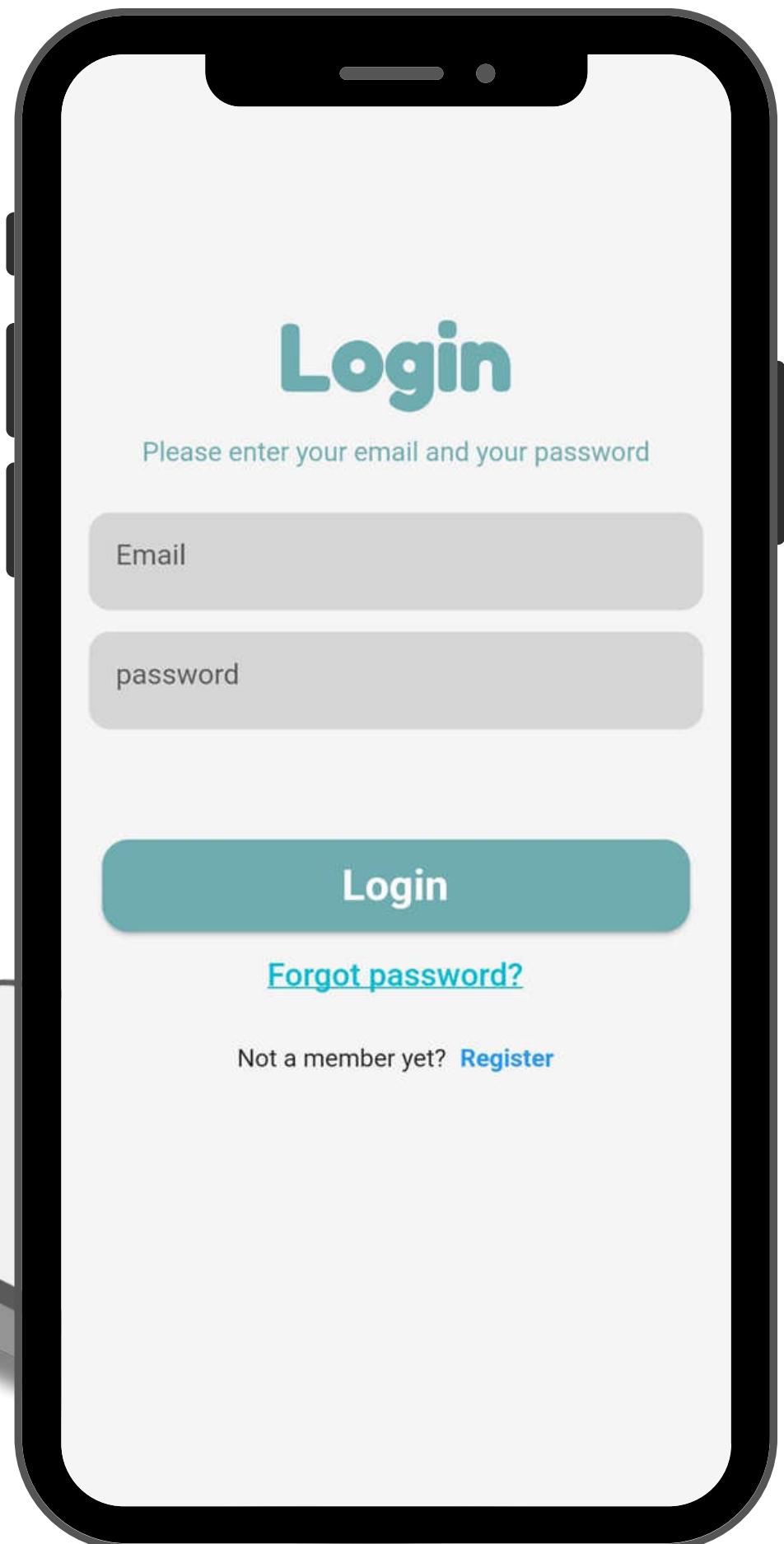
 Male ▾

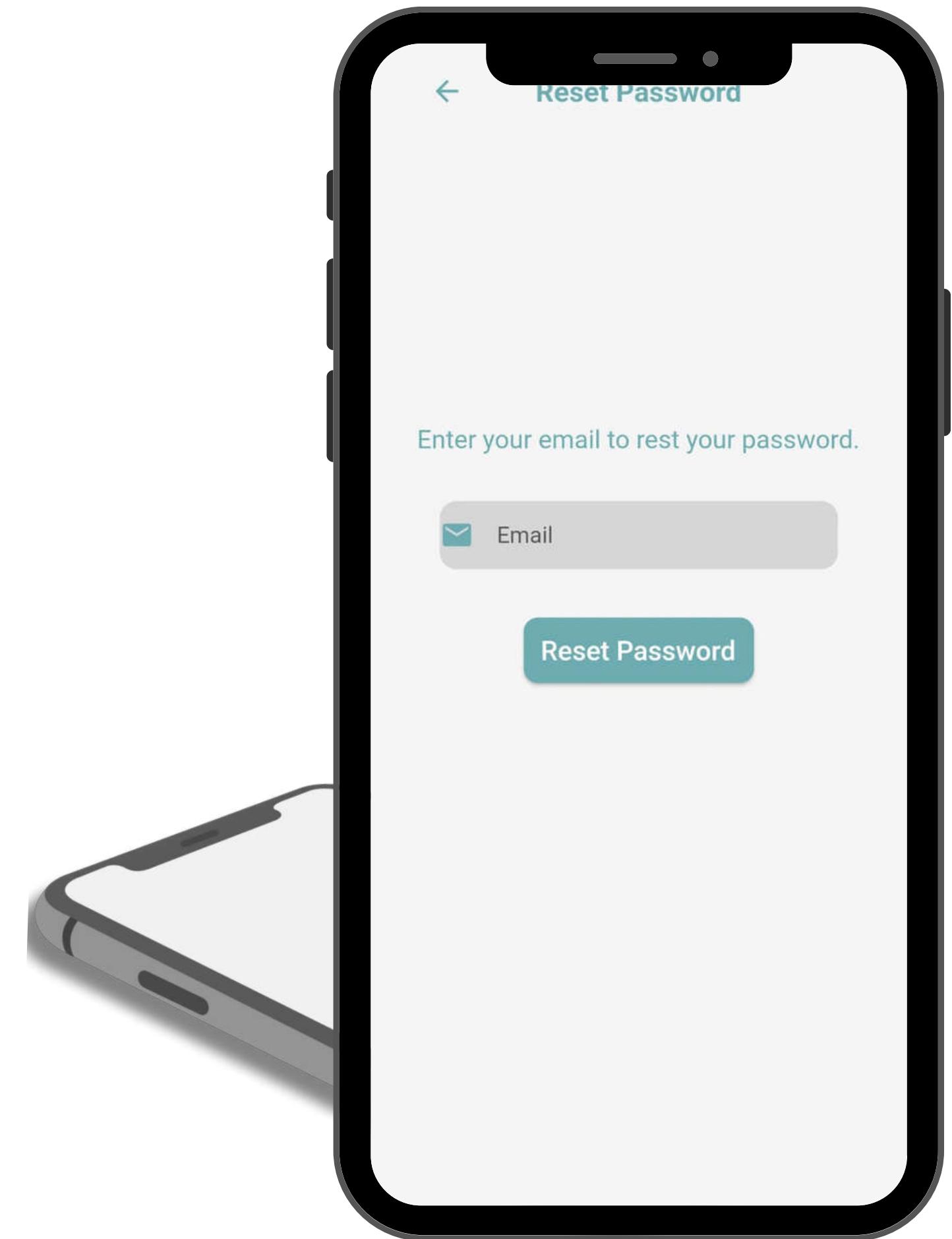
 A ▾

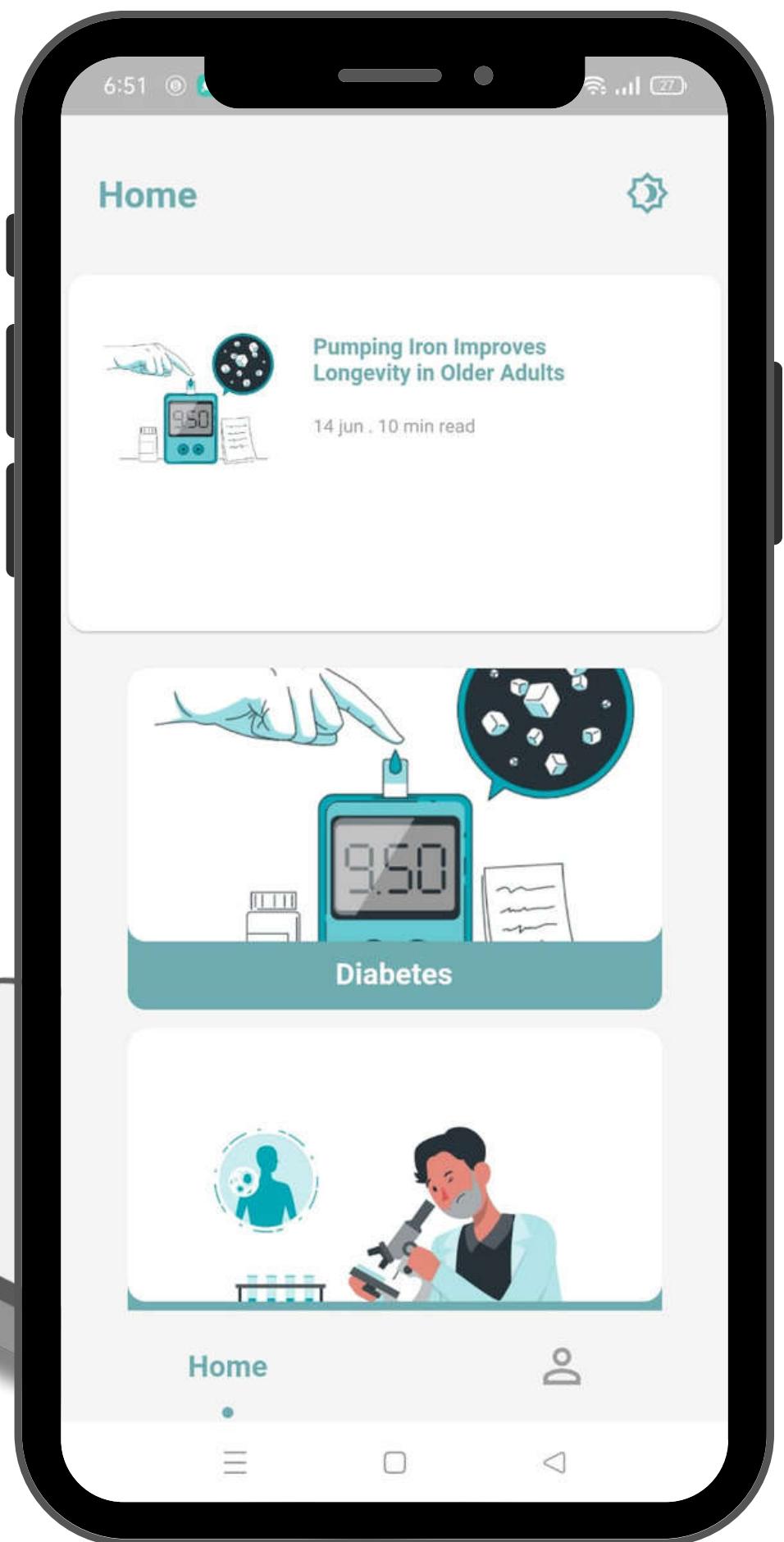
 AGE

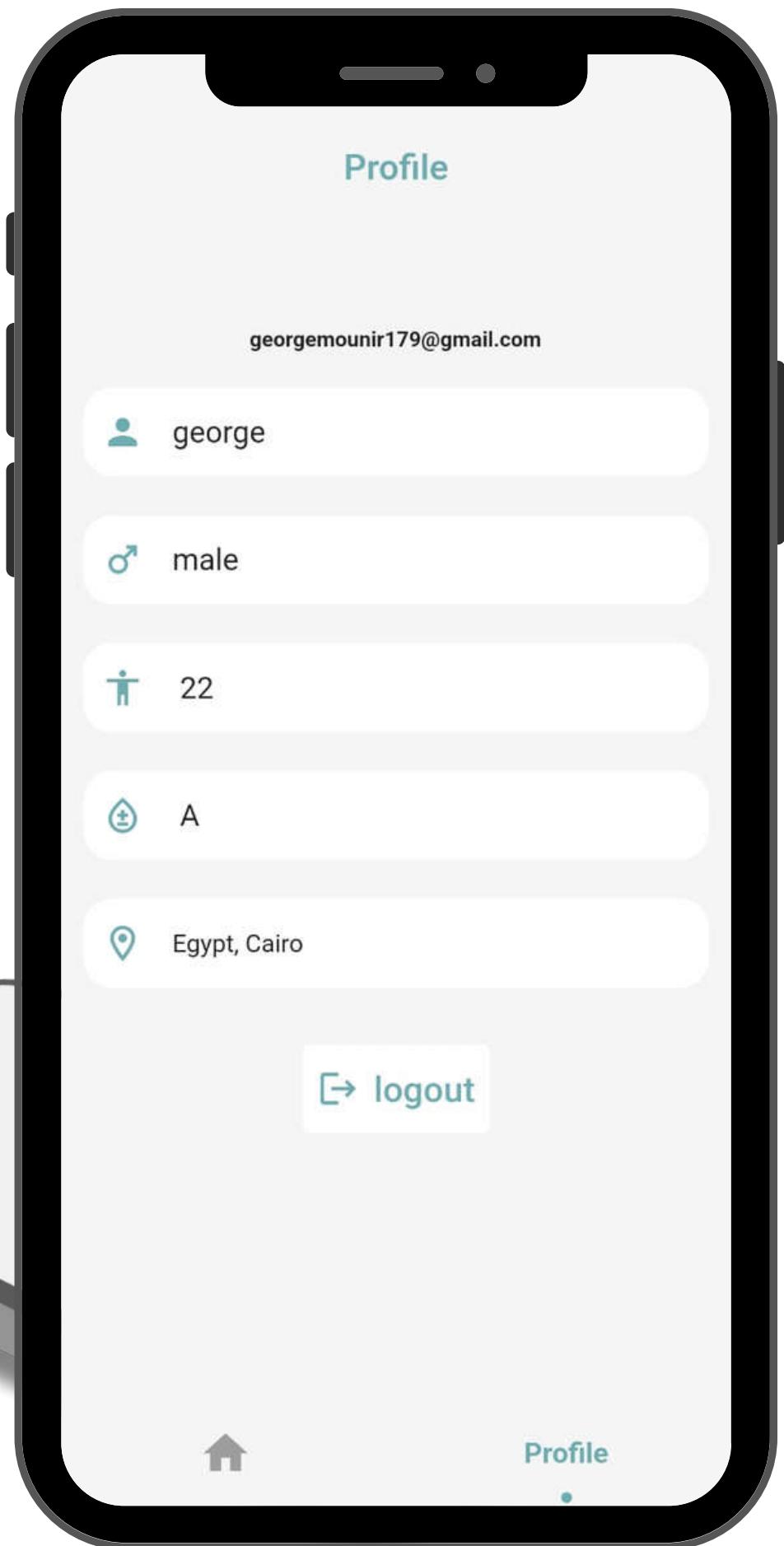
**Sign Up**

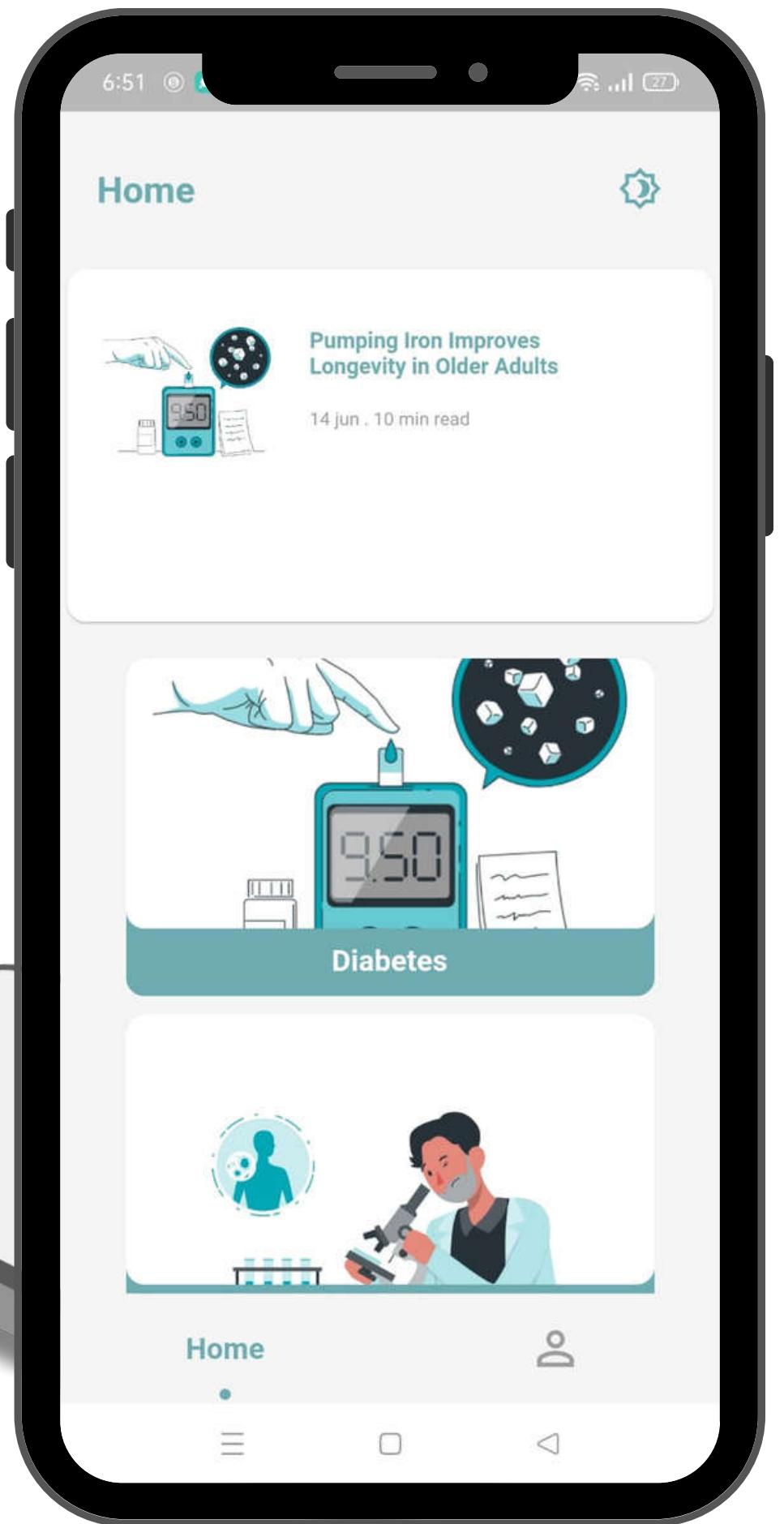
Already have an account? [Sign In](#)



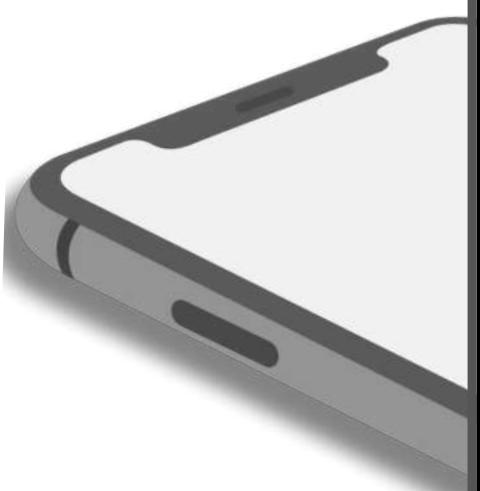
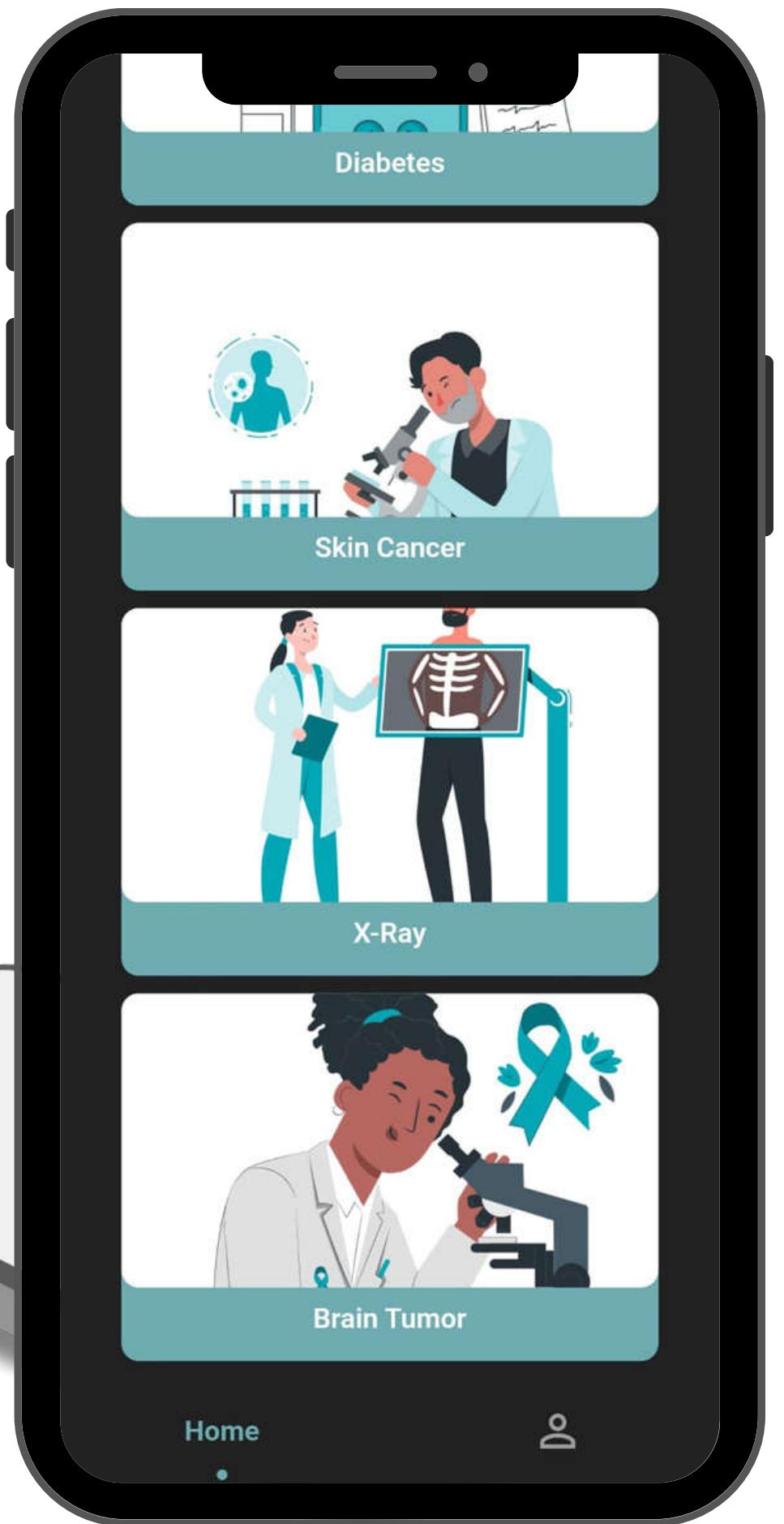


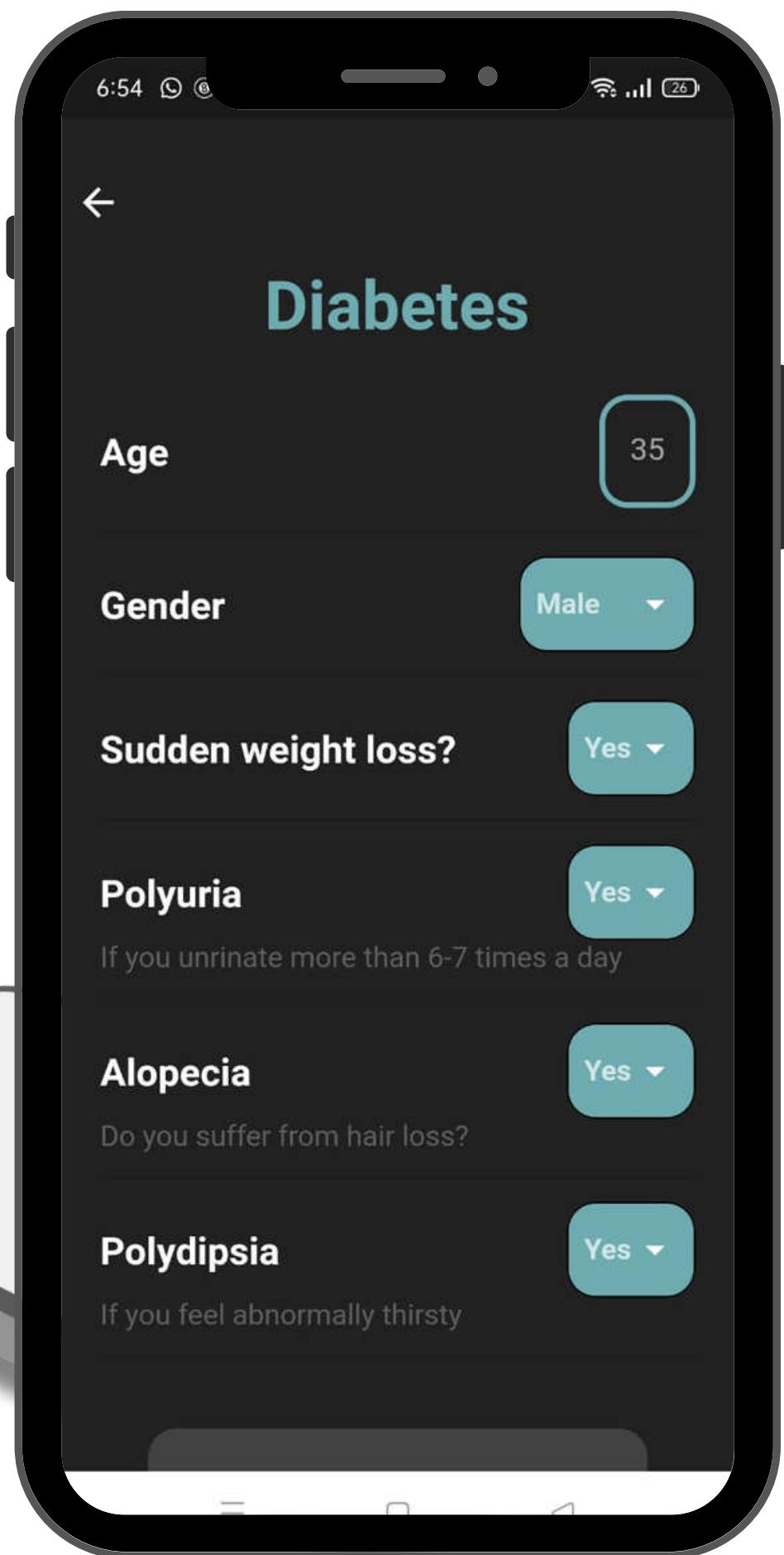


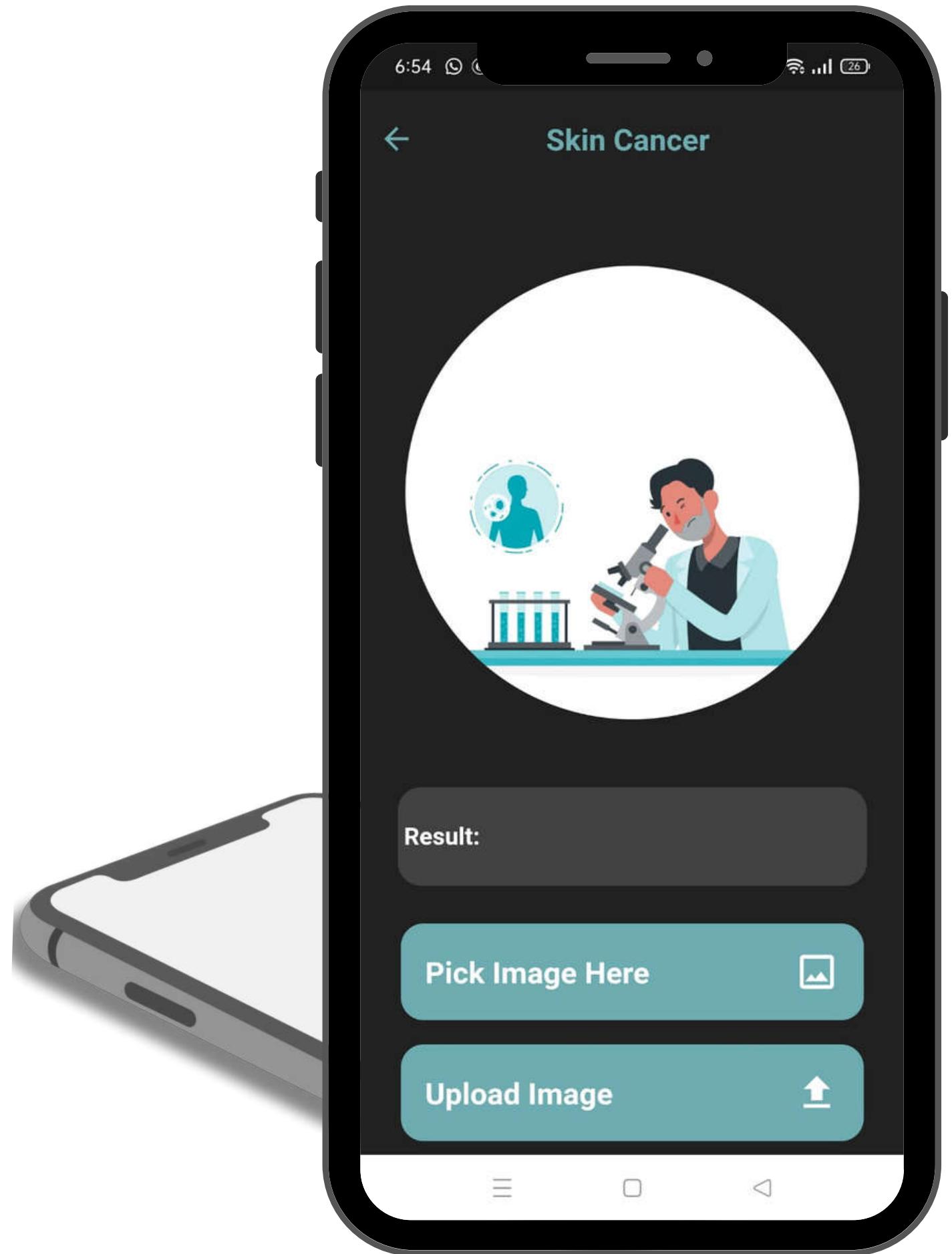


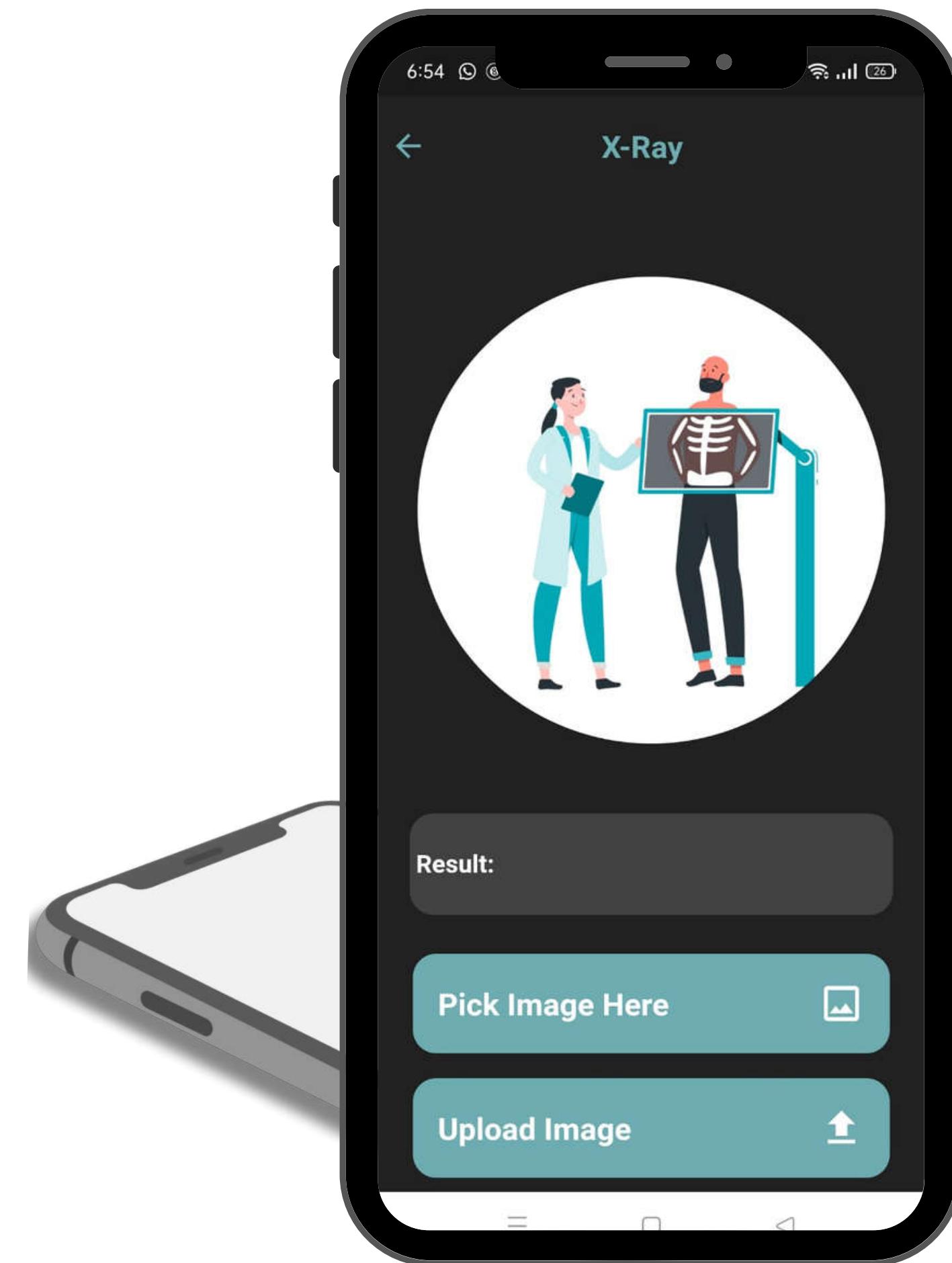


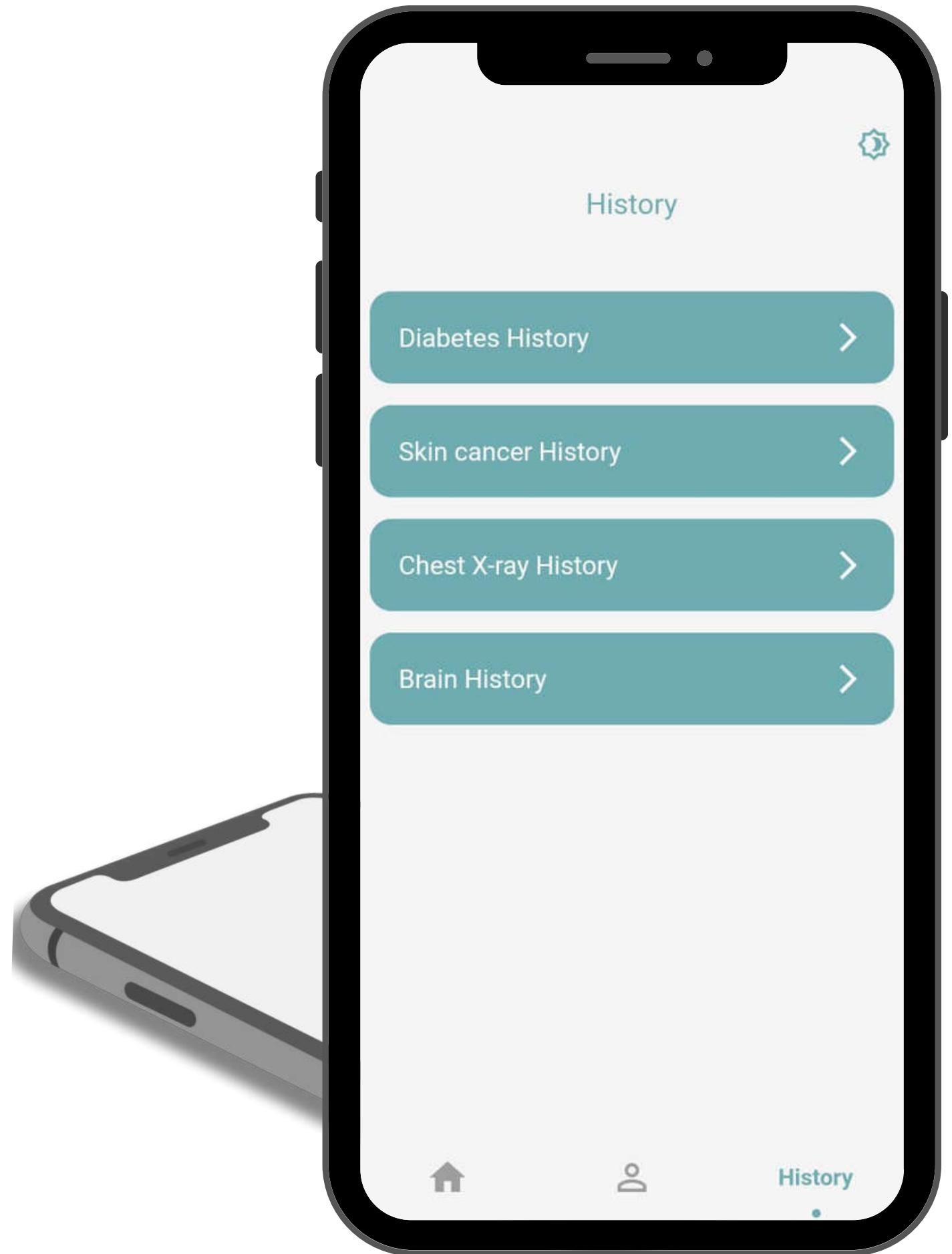


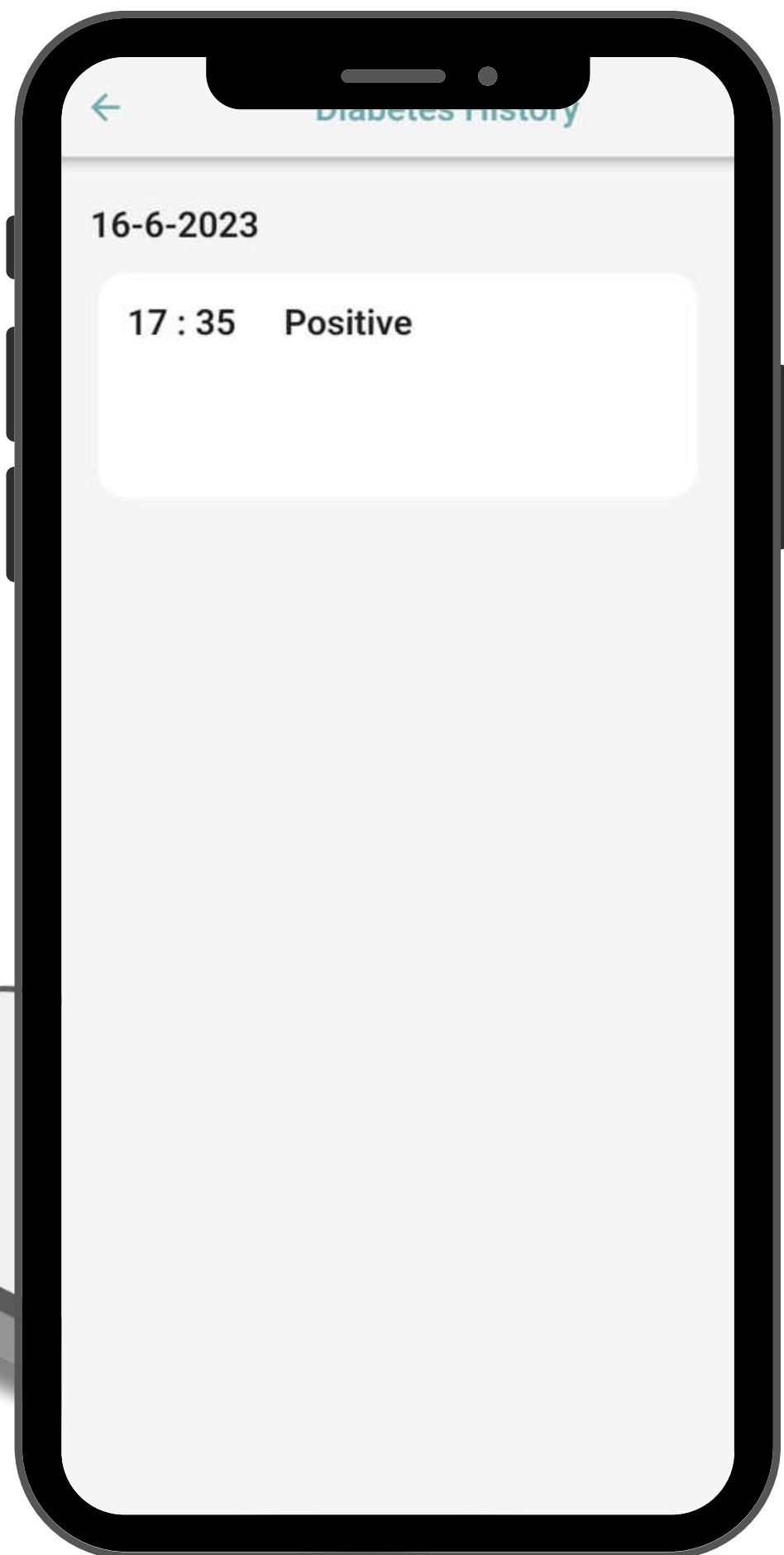




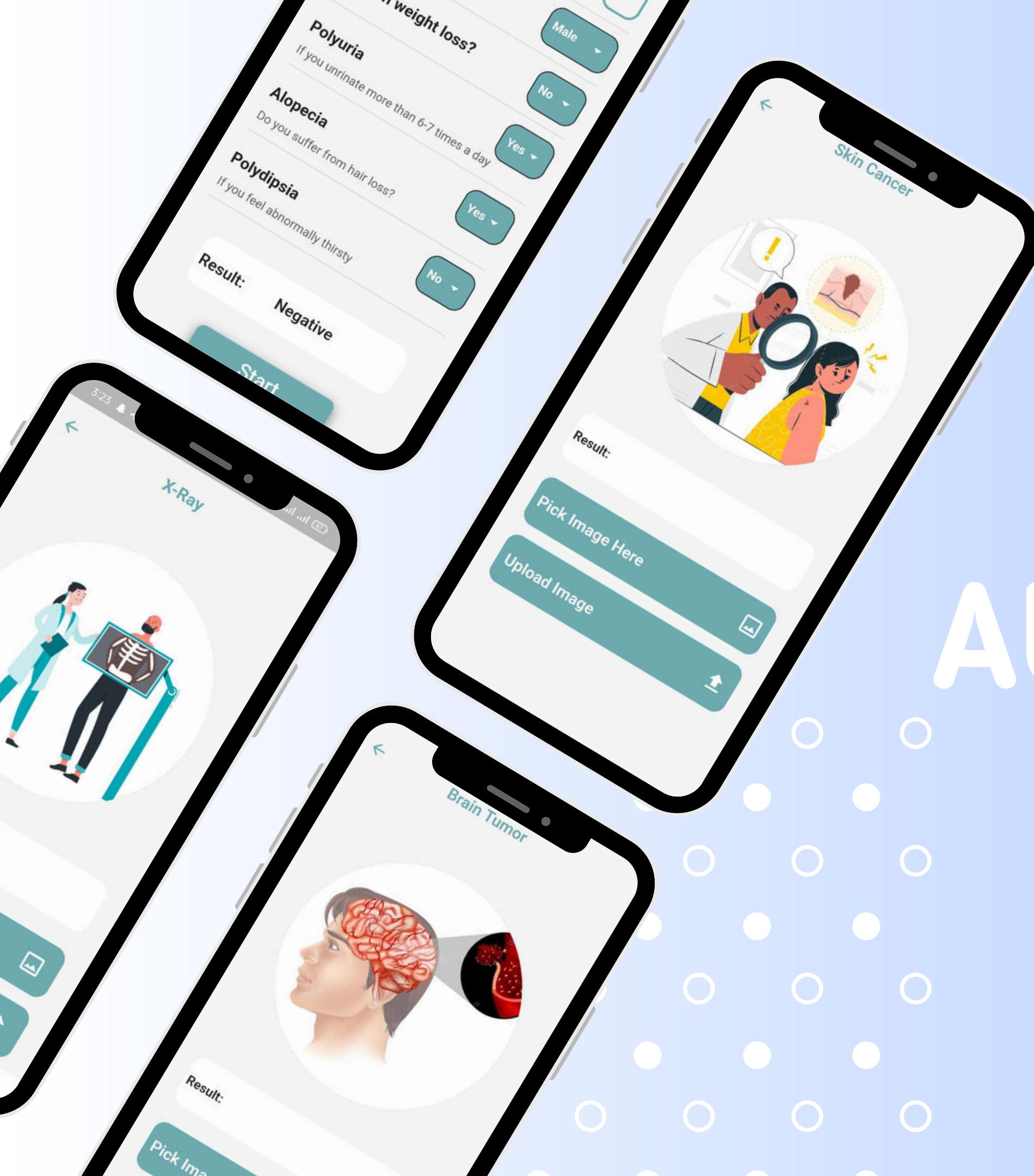








# AUTHENTCATION





# Sign Up

Please enter your login and your password



user name



Email



password



phone



Male ▾



A ▾



AGE



# Login

Please enter your email and your password

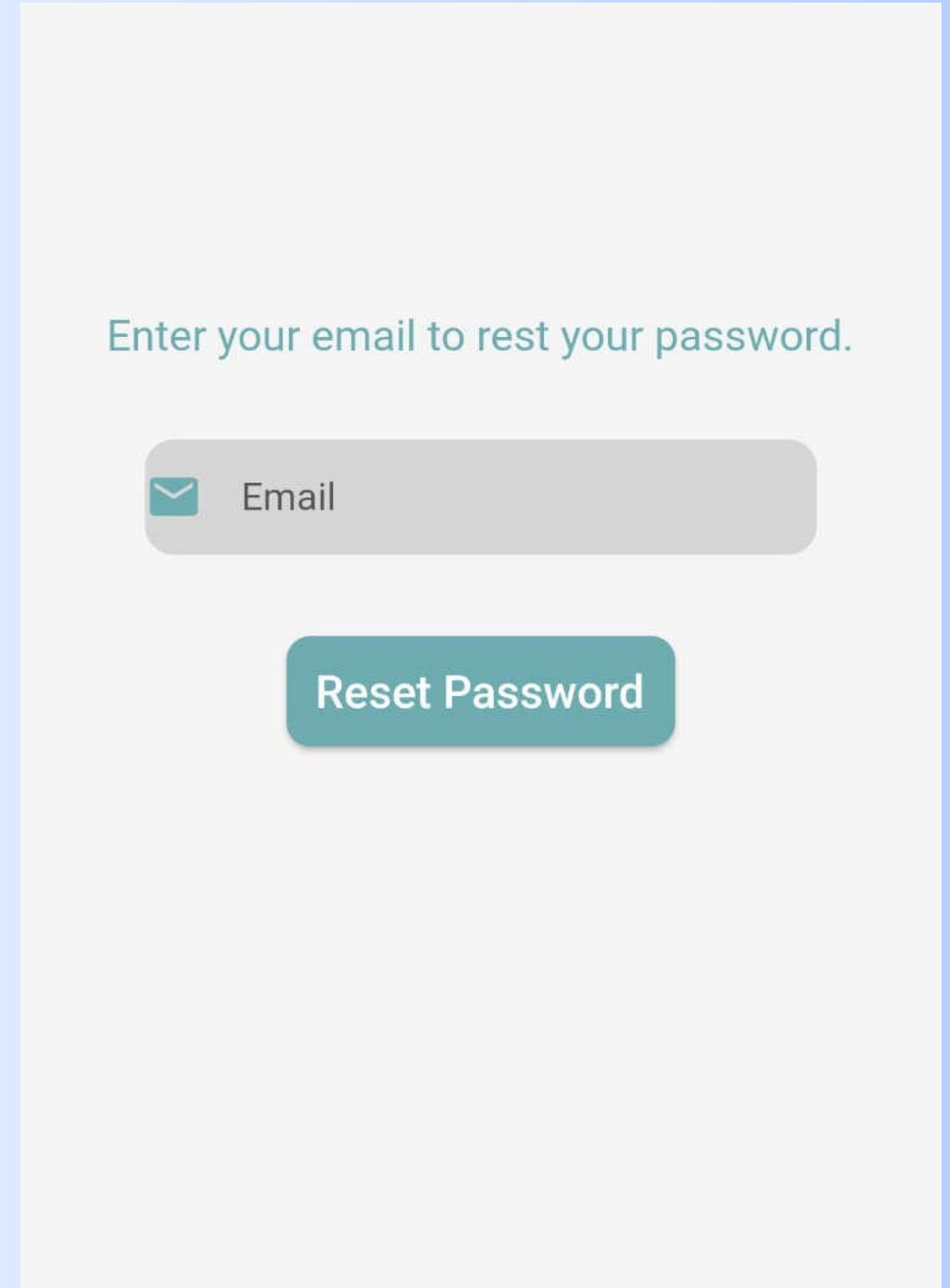
Email

password

Login

[Forgot password?](#)

Not a member yet? [\*\*Register\*\*](#)





georgemounir179@gmail.com

 george

 male

 22

 A

 Egypt, Cairo

 logout

# Clean Architecture

Separation of concerns

Testability

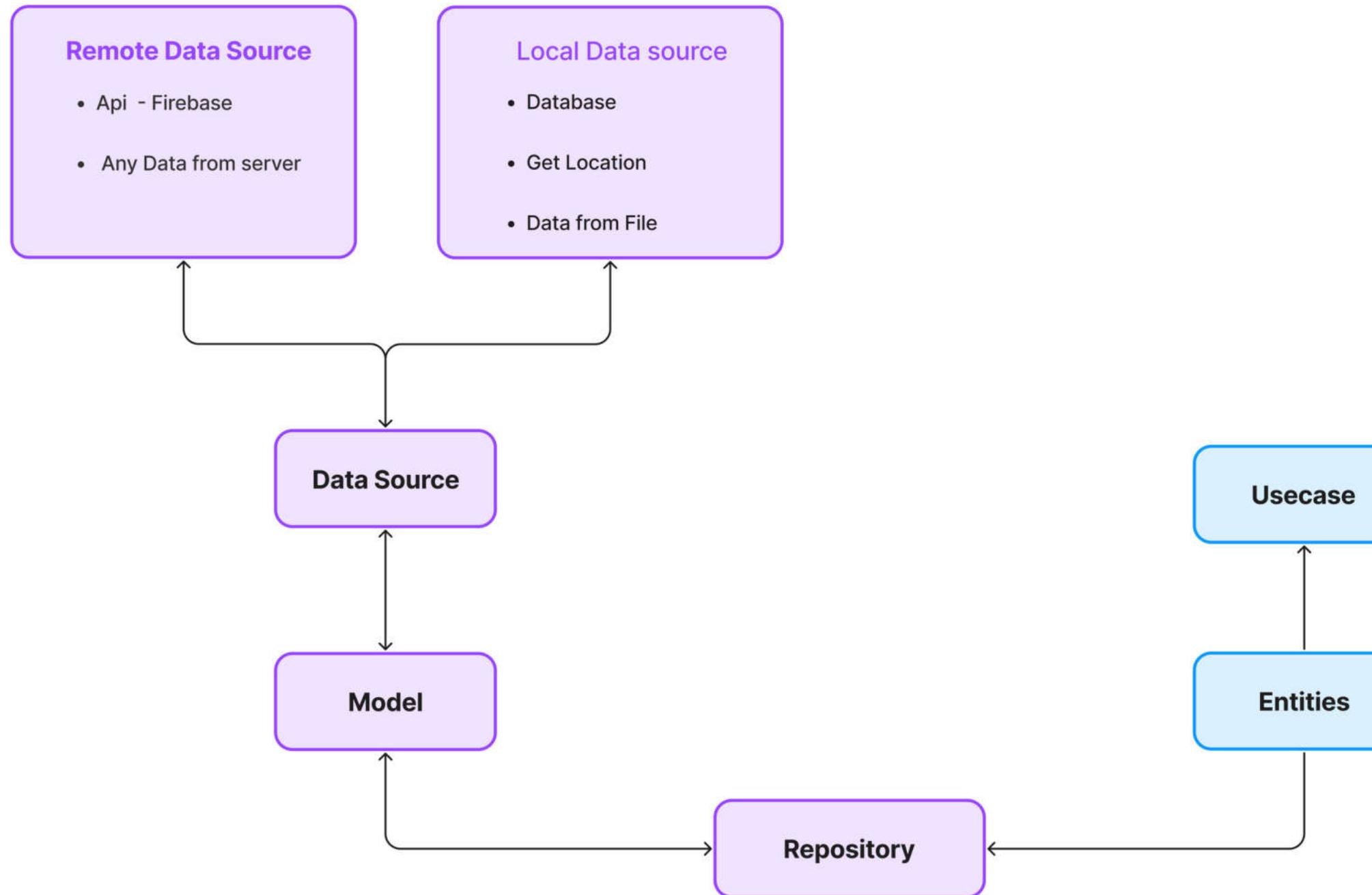
Flexibility

Independence from external  
frameworks

Maintainability

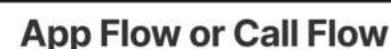
# Data

## Local Data Source

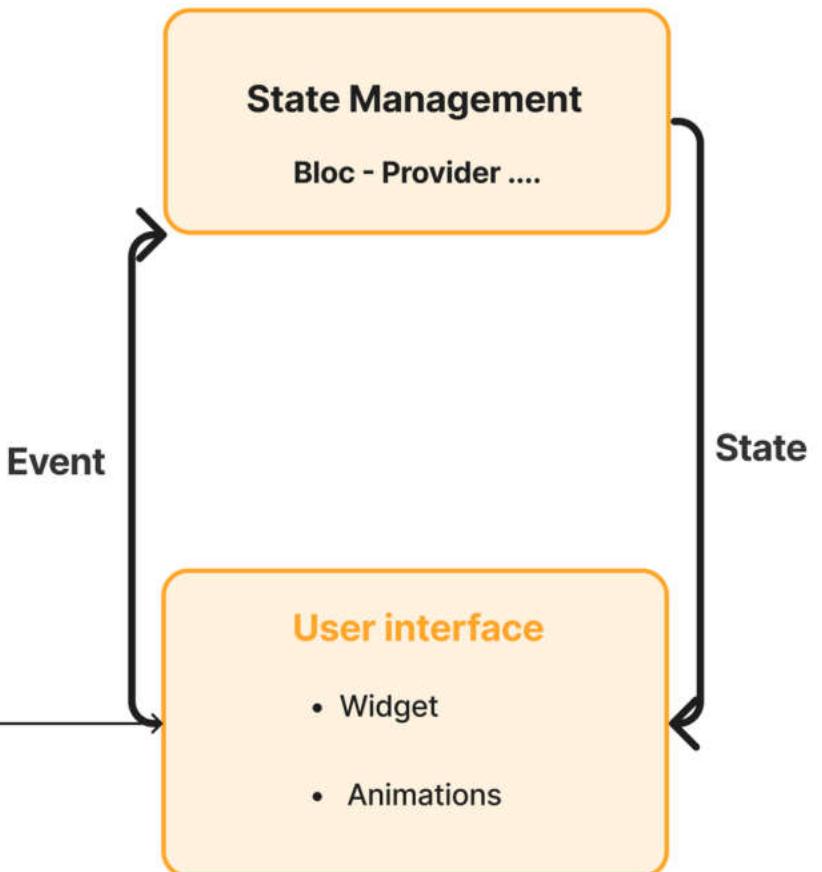


# Domain

## Just Contracts and abstract clas

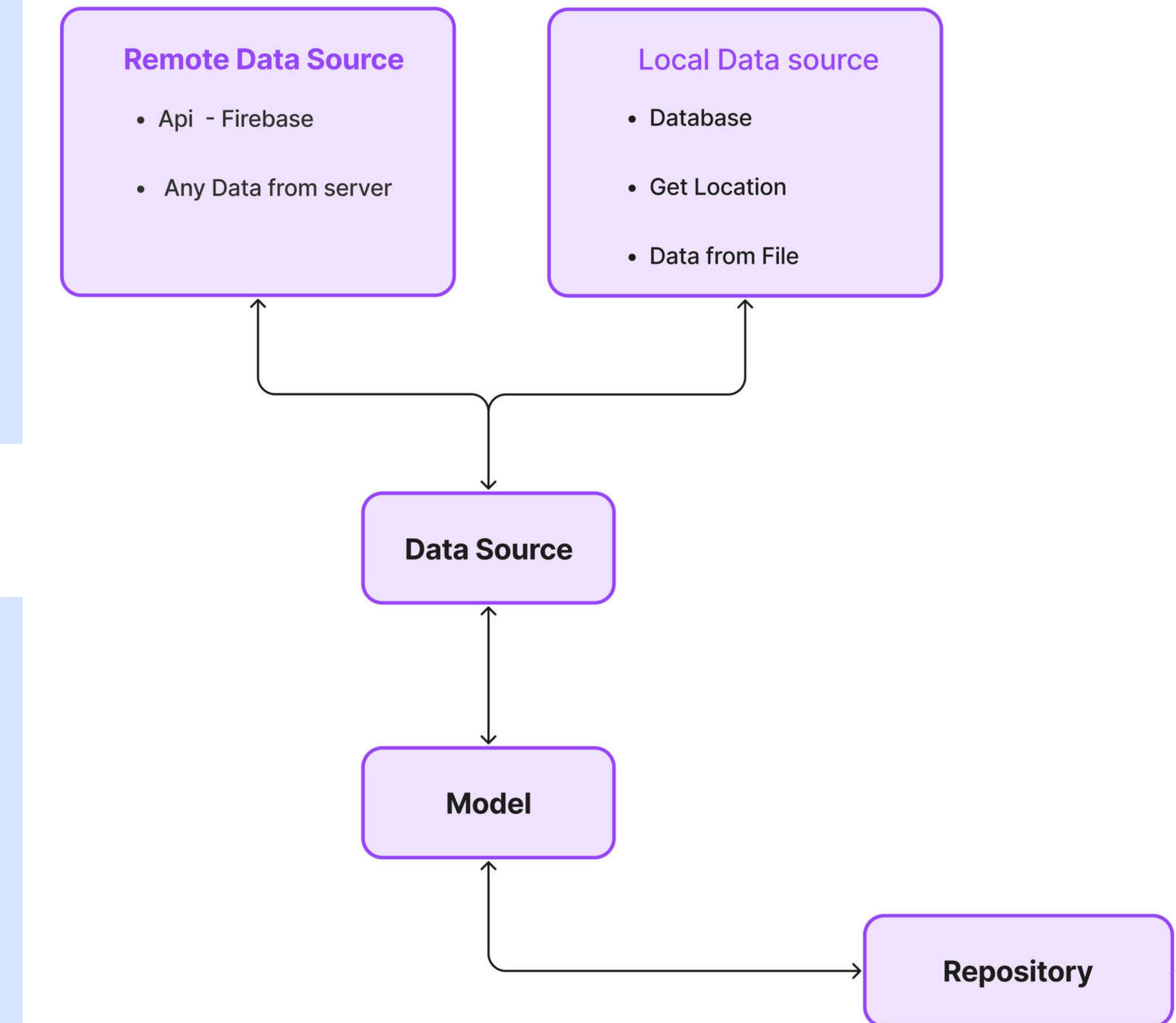


# Presentation

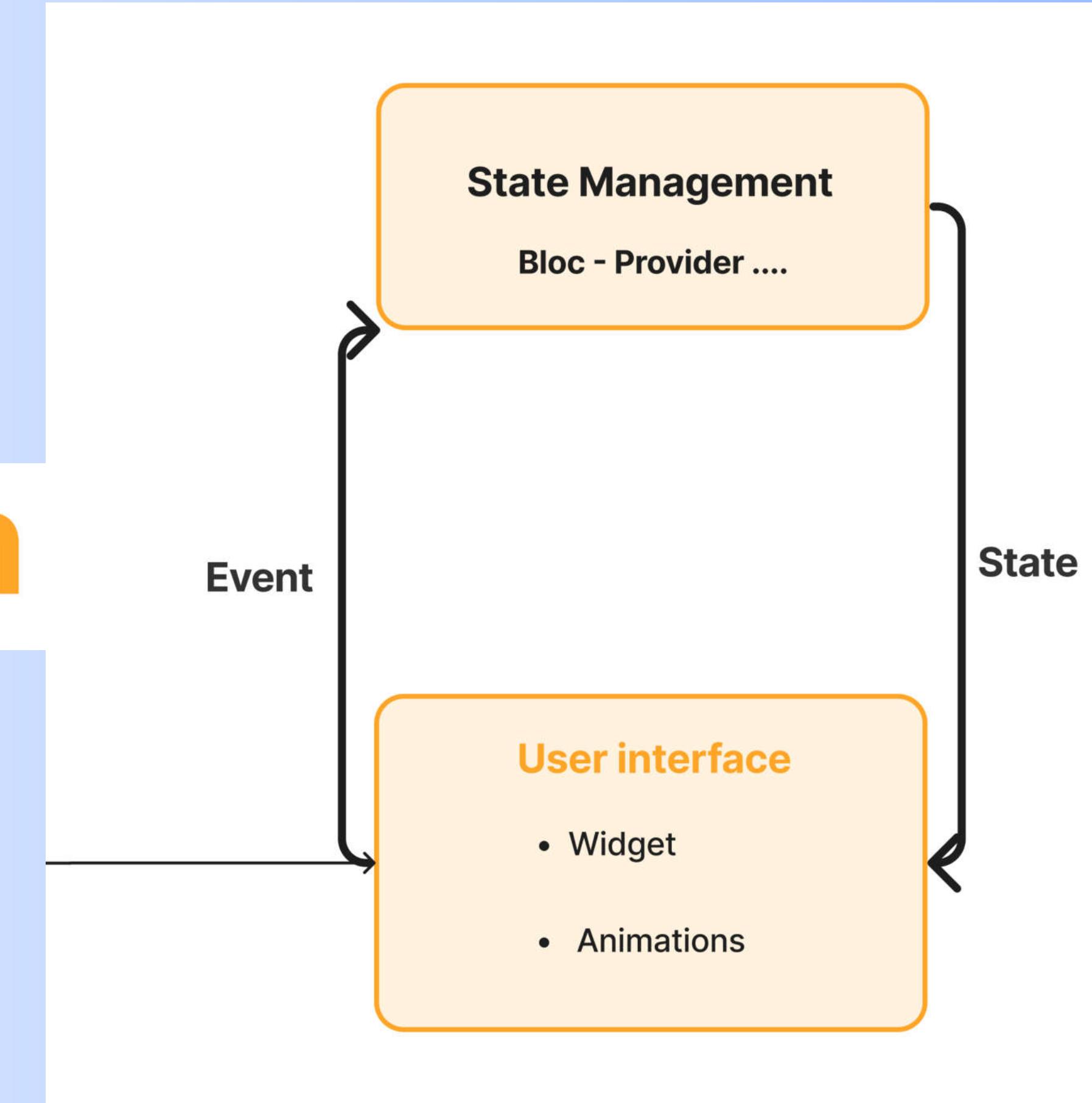


## Data Flow

# Data



# Presentation



# Domain

Usecase

Entities



# Diabetes

Age

22

Gender

Male ▾

Sudden weight loss?

No ▾

Polyuria

Yes ▾

If you urinate more than 6-7 times a day

Alopecia

Yes ▾

Do you suffer from hair loss?

Polydipsia

Yes

If you feel abnormally thirsty

No

Result:



# Diabetes

Age

22

Gender

Male ▾

Sudden weight loss?

No ▾

Polyuria

Yes ▾

If you urinate more than 6-7 times a day

Alopecia

Yes ▾

Do you suffer from hair loss?

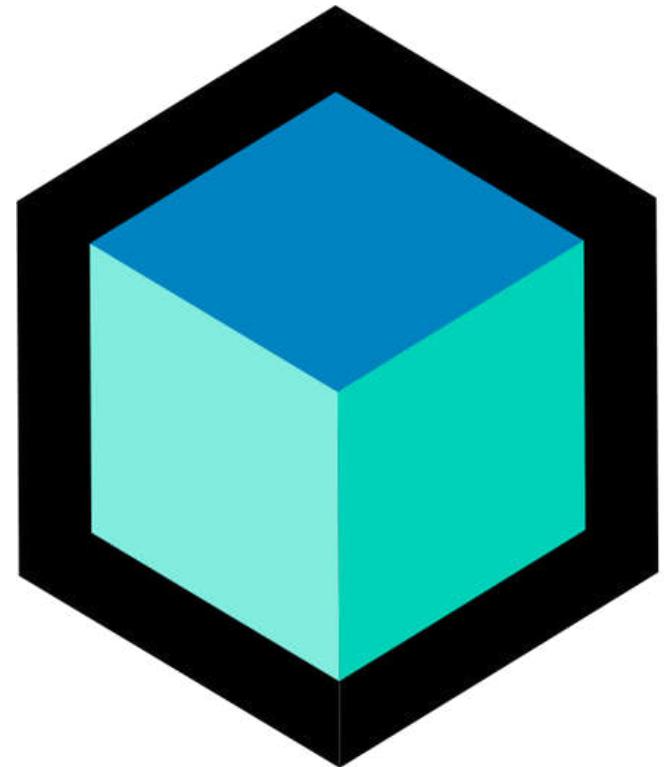
Polydipsia

No ▾

If you feel abnormally thirsty

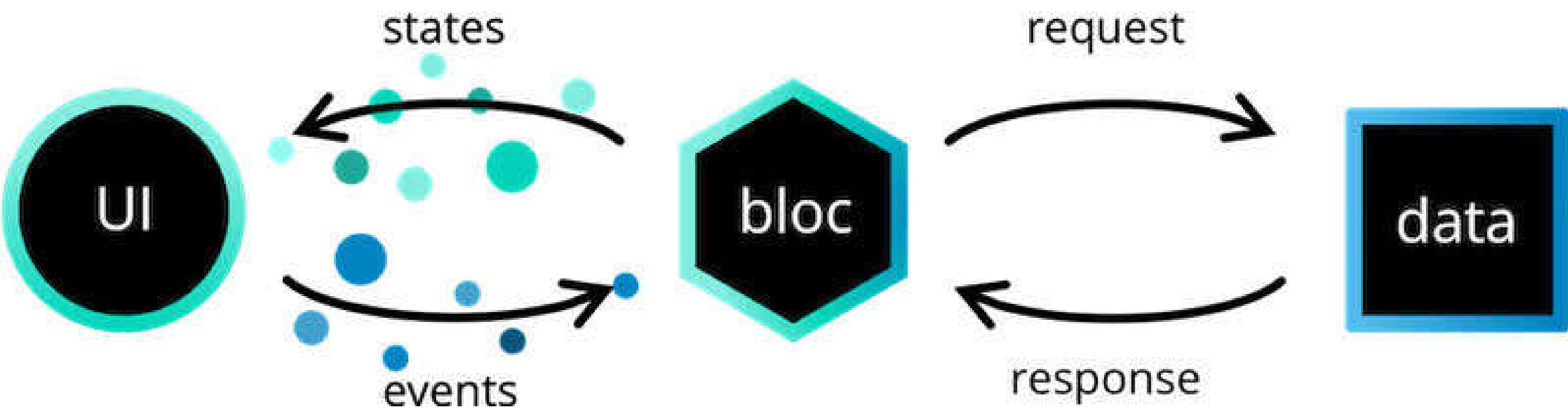
Result:      Negative

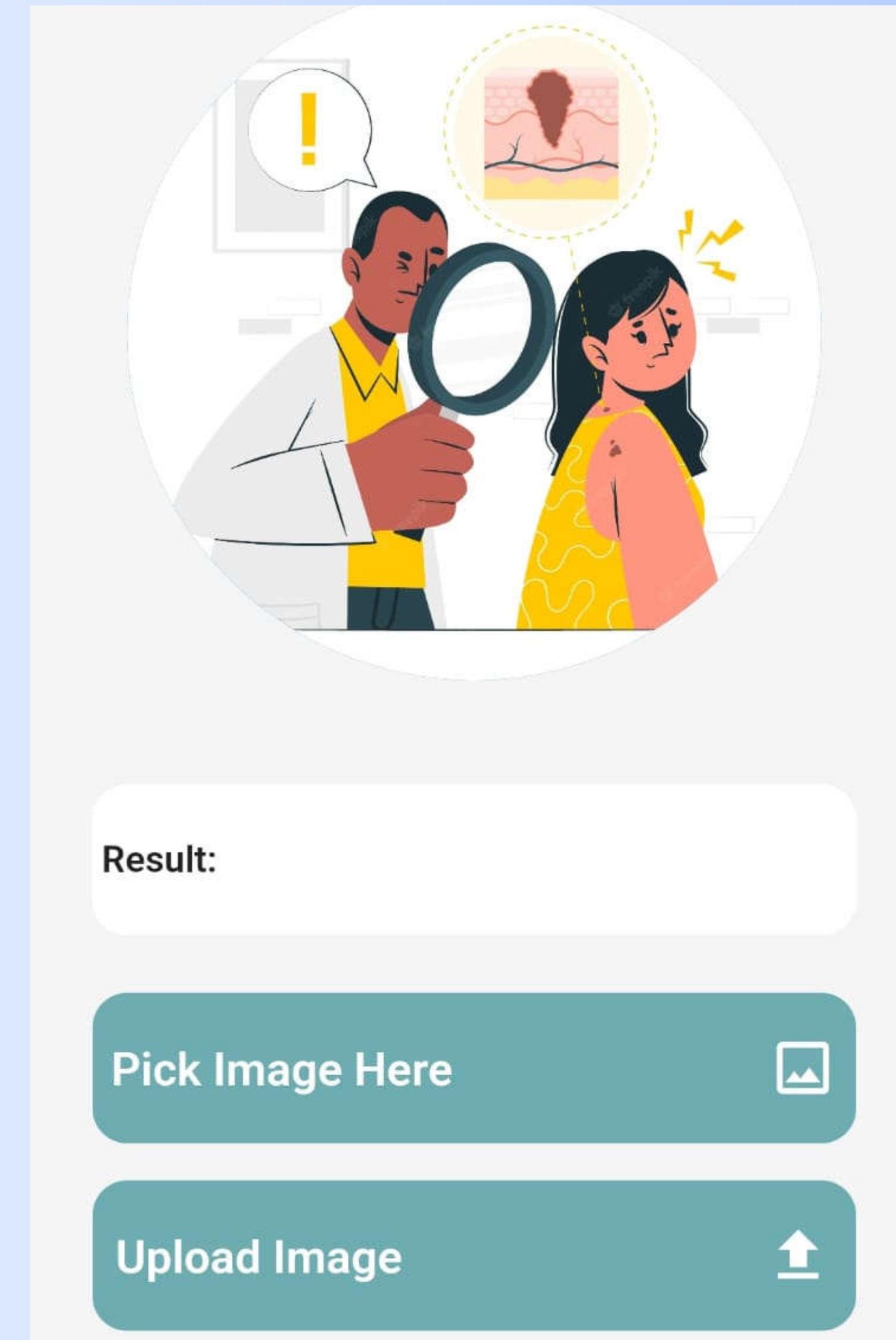
# What is



# bloc

**Flutter bloc is one of the state management for Flutter applications. You can use it to handle all the possible states of your application in an easy way.**







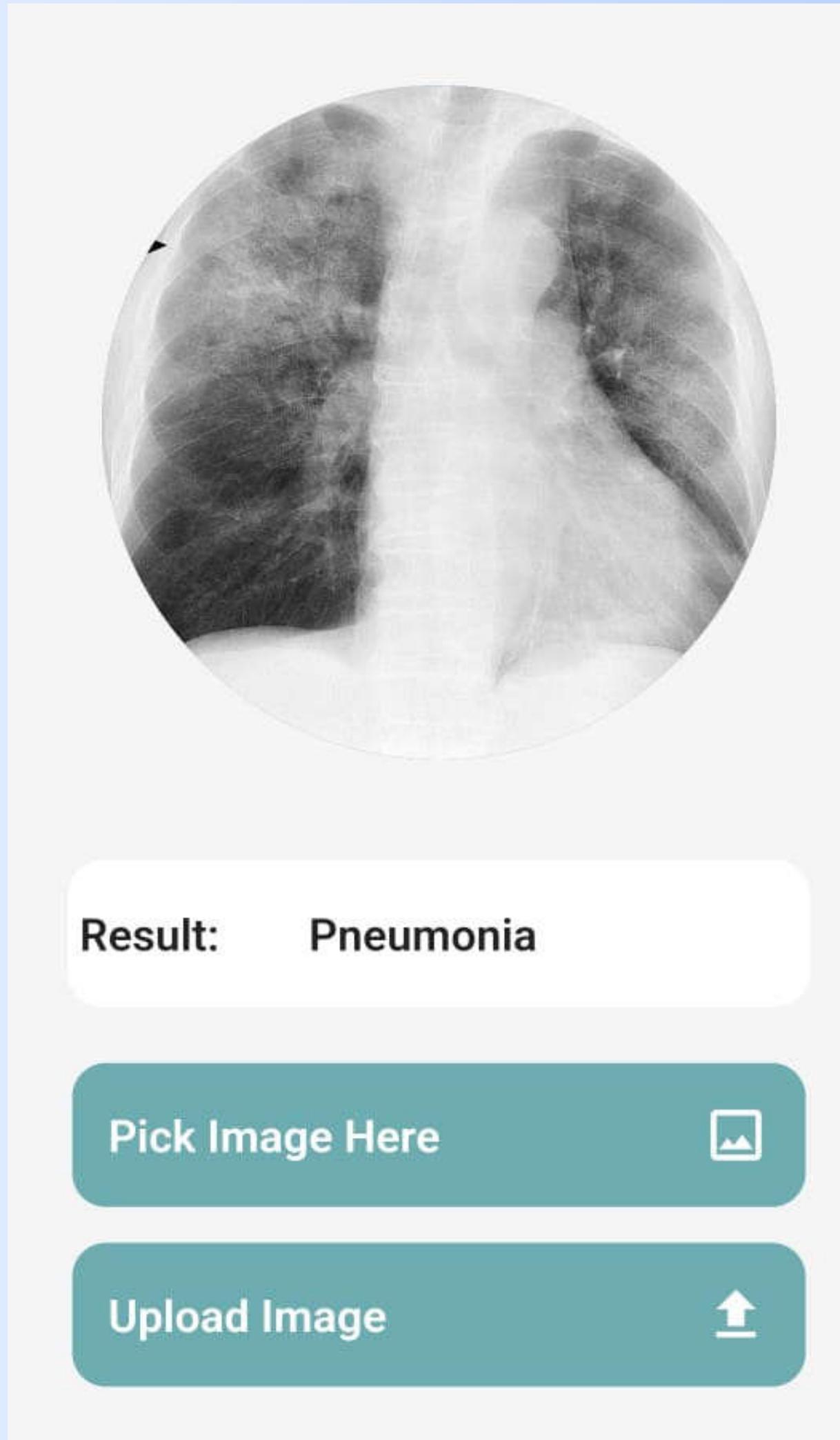
**Result:** Melanoma

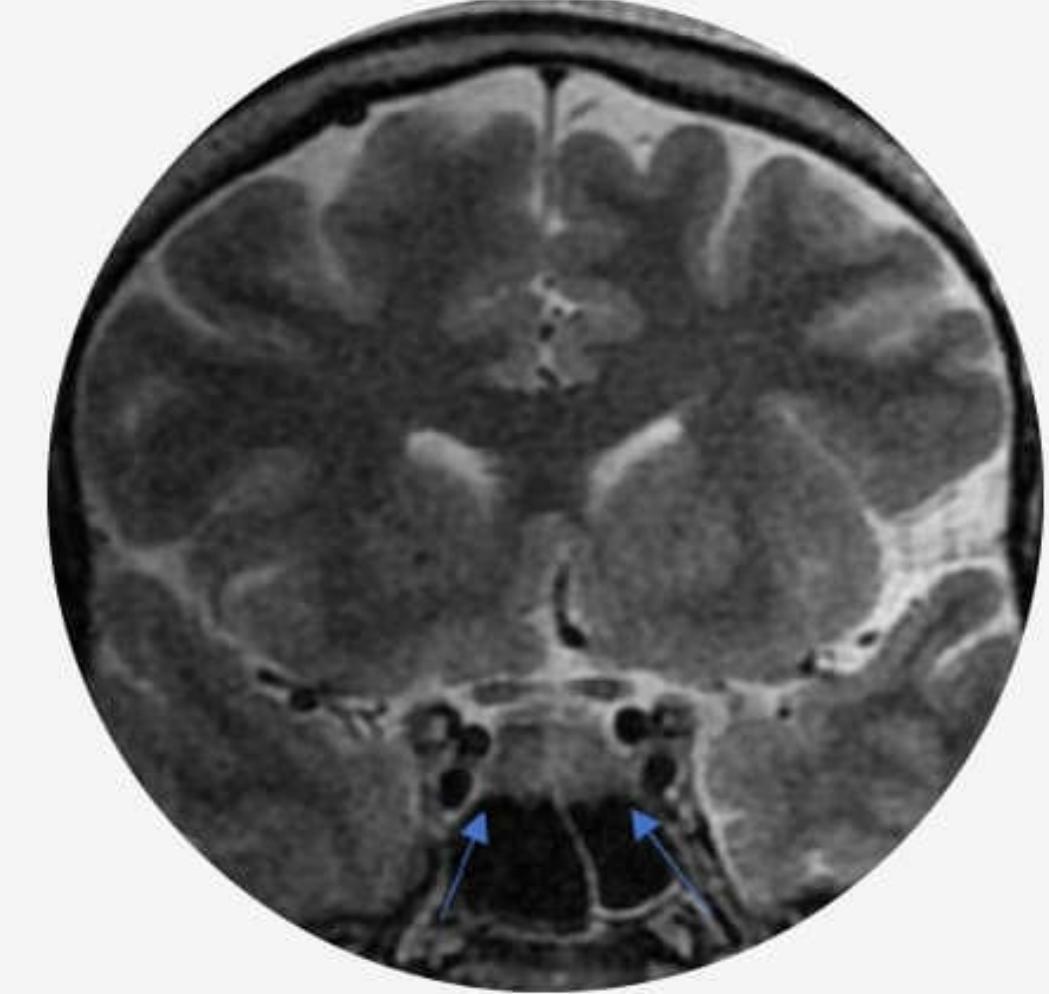
Pick Image Here



Upload Image







**Result:** No Tumor

**Pick Image Here** 

**Upload Image** 



# Thank you

I really appreciate your time.